

NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

**AN ANALYSIS OF THE F/A-18 E/F INTEGRATED
READINESS SUPPORT TEAMING (FIRST) PROGRAM
(DRAFT)**

by

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and

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June 2001

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20010814 074

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE June 2001	3. REPORT TYPE AND DATES COVERED Master's Thesis		
4. TITLE AND SUBTITLE: An Analysis of the F/A-18 E/F Integrated Readiness Support Teaming (FIRST) Program (Draft)		5. FUNDING NUMBERS		
6. AUTHOR(S) Bellos, Laura L. and Mai, Brian A.				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000		8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A		10. SPONSORING / MONITORING AGENCY REPORT NUMBER		
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.		12b. DISTRIBUTION CODE		
13. ABSTRACT (maximum 200 words) <p>Department of Defense logistics are under increasing pressure to reduce their cost of operations. As a result of many years of reliability and aging aircraft issues facing our Naval Aviation Fleet, a maintenance support contract has been developed to attempt to maintain the high reliability of the F/A-18 E/F type aircraft. Although contract logistics support has been around since World War II, the F/A-18 E/F Integrated Readiness Support Teaming program (FIRST) has extended this support to a new level as the contractor virtually assumes the role as the Inventory Control Point for this aircraft.</p> <p>This research examines F/A-18 E/F program reliability and supportability issues. We assess the FIRST contract with particular regard to how this contract will affect the parts supportability aspects as well as the maintainability/reliability rates of the aircraft and life cycle costs. An important part of this research effort is the literature review. As yet, there are no studies available on the FIRST draft that might have assisted in evaluating the program. We obtained copies of the FIRST draft along with the Task Description Document and the Awards Fee Plan. The resulting analysis and conclusions discuss these elements and provide recommendations for improvement.</p>				
14. SUBJECT TERMS Logistics, Maintenance, Outsourcing, Contractor Logistics Support, F/A-18E/F Aircraft			15. NUMBER OF PAGES 102	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18

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**AN ANALYSIS OF THE F/A-18 E/F INTEGRATED READINESS SUPPORT
TEAMING (FIRST) PROGRAM (DRAFT)**

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MASTER OF SCIENCE IN MANAGEMENT

from the

**NAVAL POSTGRADUATE SCHOOL
June 2001**

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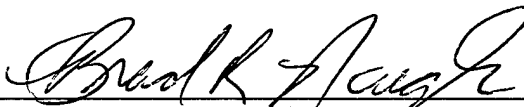


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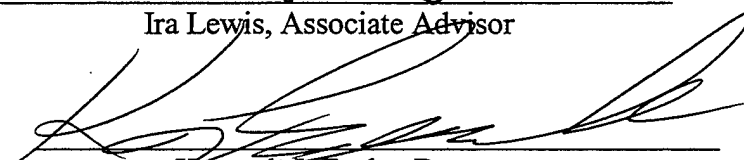
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ABSTRACT

Department of Defense logistics are under increasing pressure to reduce their cost of operations. As a result of many years of reliability and aging aircraft issues facing our Naval Aviation Fleet, a maintenance support contract has been developed to attempt to maintain the high reliability of the F/A-18 E/F type aircraft. Although contract logistics support has been around since World War II, the F/A-18 E/F Integrated Readiness Support Teaming program (FIRST) has extended this support to a new level as the contractor virtually assumes the role as the Inventory Control Point for this aircraft.

This research examines F/A-18 E/F program reliability and supportability issues. We assess the FIRST contract with particular regard to how this contract will affect the parts supportability aspects as well as the maintainability/reliability rates of the aircraft and life cycle costs. An important part of this research effort is the literature review. As yet, there are no studies available on the FIRST draft that might have assisted in evaluating the program. We obtained copies of the FIRST draft along with the Task Description Document and the Awards Fee Plan. The resulting analysis and conclusions discuss these elements and provide recommendations for improvement.

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TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	GENERAL.....	1
B.	BACKGROUND	1
C.	OBJECTIVES	2
D.	RESEARCH QUESTIONS.....	3
1.	Primary Research Question	3
2.	Secondary Research Questions.....	3
E.	DISCUSSION	3
F.	SCOPE	4
G.	METHODOLOGY	5
H.	ORGANIZATION	5
II.	BACKGROUND	9
A.	BACKGROUND	9
B.	CONTRACTOR LOGISTICS SUPPORT	10
1.	Background	10
2.	Major Elements of System-Level Contracting.....	11
3.	The Organizations.....	12
4.	Commercial Operations Within DoD.....	13
5.	DoD Support Contracting	14
6.	Summary.....	15
C.	TASK DESCRIPTION DOCUMENT FOR THE FIRST (DRAFT).....	15
1.	Integrated Product Teams	16
D.	F/A-18E/F INTEGRATED READINESS SUPPORT TEAMING (FIRST) PROGRAM (DRAFT).....	17
1.	Description of Program	17
2.	Statement of Need	17
3.	Description of Phases	18
4.	Life Cycle Cost	18
5.	Capability of Performance	19
6.	Depot Support	19
7.	Logistics Considerations.....	19
E.	AWARD FEE PLAN	20
F.	SUMMARY	20
III.	DATA	21
A.	SUPPORTABILITY	21
B.	INCREASED RELIABILITY	26
C.	LIFE CYCLE COST	31
D.	MEAN TIME BETWEEN FAILURES	32
1.	Top Readiness Degradars.....	32
2.	MTBF Data Provided by NAVICP as of March 16, 2001	33

3.	Mean Flight Hours Between Operation Mission Failure E and F models:.....	34
IV.	ANALYSIS OF DATA	35
A.	PARTS SUPPORTABILITY ISSUES	35
1.	Supply Chain Management/Forecasting Services/Asset Management Data.....	35
2.	Managing Inventory	36
3.	Supply Response Time.....	37
4.	Risks Associated With Parts Supportability	38
5.	Parts Support Summary.....	39
B.	RELIABILITY AND MAINTAINABILITY DETAILS.....	40
1.	Reliability Based Logistics/Trigger Based Asset Management	40
2.	Long-Term Logistics Impact	40
3.	Logistics Measures of Performance	41
4.	Reliability and Maintainability Summary.....	42
C.	LIFE CYCLE COST	43
D.	MTBF AND TOP DRIVERS	43
E.	SUMMARY	45
V.	CONCLUSIONS AND RECOMMENDATIONS.....	47
A.	CONCLUSIONS	47
1.	Parts Supportability - When Implemented, Should the FIRST Contract Meet the Expectations for Parts Supportability?	47
2.	Reliability and Maintainability - Should the FIRST Contract Meet the Expectations for Increased Reliability and Maintainability?.....	47
3.	Life Cycle Cost - Does the FIRST Contract have the Potential to Reduce the Aircrafts' Life Cycle Cost?	48
B.	RECOMMENDATIONS.....	48
1.	Parts Supportability.....	48
2.	Reliability and Maintainability.....	49
3.	Life Cycle Cost	49
C.	SUGGESTED FURTHER STUDIES	50
	LIST OF REFERENCES	51
	APPENDIX A. DATA SPECIFIED IN THE TASK DESCRIPTION DOCUMENT (TDD)	53
	APPENDIX B. EXCERPTS FROM THE FIRST CONTRACT (DRAFT) AND STATEMENT OF WORK.....	61
	APPENDIX C. EXCERPTS FROM THE AWARD FEE PLAN.....	71
	APPENDIX D. F/A-18 E/F RELIABILITY AND MAINTENANCE METRICS 2001 [REF. 9].....	81
	INITIAL DISTRIBUTION LIST	83

LIST OF FIGURES

Figure 1.	Top Degraders MTBF.....	33
Figure 2.	F/A-18 E MFHBF.....	34
Figure 3.	F/A-18 F MFHBF.....	34

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LIST OF TABLES

Table 1.	Technical Performance Measures.	29
Table 2.	Performance Monitors.	29
Table 3	Data Systems. "After Appendix C".	29

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ACKNOWLEDGMENTS

The authors would like to acknowledge the following individuals who provided their support throughout the information-gathering phase of this thesis:

1. Professor, Dr. Ira Lewis
2. Brad Naegle (LtCol Ret)
3. Don Eaton, (RADM Ret.)
4. Tamela Kozior
5. Stephen G Strayer
6. LtCol Stephen Watkins
7. Anita Perlman
8. Karen Bain
9. Ann Owens

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I. INTRODUCTION

A. GENERAL

As a result of many years of reliability and aging aircraft issues facing our Naval Aviation Fleet, a maintenance support contract is being developed to attempt to maintain the high reliability of the F/A-18 E/F type aircraft. Discussions about a Government/Industry partnership have evolved into identifying a better way to logistically support the F/A-18 E/F. The partnership evolved into the F/A-18 E/F Integrated Readiness Support Teaming Program, or FIRST. [Ref. 1] By avoiding the duplication of effort inherent in traditional logistics support and by integrating existing Government and industry capabilities it is concluded a more affordable and reliable logistics process can be formed. Incentive and award fee provisions will be in the contract to motivate reliability improvements, get quicker material deliveries, obtain better fleet technical support and reduce the overall cost of logistics support.

Ongoing efforts throughout DoD continue to include such initiatives as Contractor Logistics Support (CLS) techniques used to integrate the best practice and cost effectiveness of integrating DoD and Civilian contractors. These initiatives are after the same thing, maintaining high reliability for the life cycle of the aircraft.

B. BACKGROUND

The scope this research centers upon is the Naval aerospace industry. In particular, the F/A-18 E/F FIRST program reliability issues. As the Defense budget shrinks, the Services must find more efficient ways to develop and support weapons systems. Each year, billions of Federal dollars are allocated to purchase advanced aircraft, electronics and aviation support equipment. Given the huge outlays, political

oversight, and significant impact on the industrial base, there is incentive for the Government to closely monitor any new initiative, including logistics support contracts. As aviation technology becomes more complex, the Navy must find new ways to guarantee logistics supportability of the systems throughout their life cycle.

If problems with reliability exist, but are not resolved quickly, readiness challenges become harder to overcome. The joint military and civilian relationships are enhanced as they combine knowledge bases through the use of Integrated Product Teams (IPT). The Department of Defense and the Navy acknowledge this success and have adapted the concept for their use during the entire development of the FIRST. With all the players involved, Naval Air Systems Command (NAVAIR), Naval Inventory Control Point (NAVICP) and Boeing, the objectives of the contracts can be developed with a consensus from all members.

C. OBJECTIVES

This research will assess the F/A-18E/F Integrated Readiness Support Teaming (FIRST) Program draft with particular regard to how this DoD action will affect the life-cycle maintainability and reliability rates of the F/A-18 E/F. It is the goal of the researchers to analyze and provide recommendations that would reduce life cycle cost and increase sustainable reliability rates for future aircraft procurement.

The specific objectives of this analysis are as follows:

- Provide background on the Navy's FIRST Program initiative
- Identify details of the reliability improvement criteria requirements and how Boeing will implement them
- Identify any shortfalls relating to the system reliability improvement techniques

- Present findings such that trends in the data can be determined
- Provide recommendations based upon the trends in the data

D. RESEARCH QUESTIONS

1. Primary Research Question

Is the Navy's new F/A-18E/F Integrated Readiness Support Teaming (FIRST) Program (draft) a viable option for the F/A-18 E/F in terms of maintainability and reliability?

2. Secondary Research Questions

- When implemented, should the FIRST contract meet the expectations for parts supportability?
- Should the FIRST contract meet the expectations for increased reliability and maintainability?
- Does the FIRST contract have the potential to reduce the aircrafts' life cycle cost?
- What are the top reliability drivers relating to Mean Time Between Failures (MTBF)? And, should this new maintenance support contract improve the MTBF rates for existing F/A-18 E/F aircraft?

E. DISCUSSION

The historical data on the reliability rates of the F/A-18 E/F is limited. However, experts in the fleet have noted that numerous components used in aircraft have considerably lower Mean Time Between Failure rates than what was originally expected from manufacturers. The differences between Military Specifications (MILSPEC) as compared to the new acquisition strategy of performance based requirements play a significant role in the Mean Time Between Failure (MTBF) rates. Time and money required verifying MTBF's of all components prior to aircraft production during Operational Test & Evaluation (OTE) has been a significant factor in the inability to accurately assess the failure rates in the aircraft once it has been fielded.

Once an aircraft has been fielded, it is in the hands of the users to repair, maintain, upgrade or modify. The maintainers in the fleet, both at the Operational Level (O-level) and Intermediate Level (I-level) can provide input or suggestions to the Original Equipment Manufacturer (OEM) on ideas for improvements or issues relating to reliability or lack of reliability of components or sub-components. The maintainers themselves have no control over the reliability of the components besides day-to-day upkeep and maintenance of systems, included but limited to repair and replacement.

It becomes difficult and very expensive as time goes by to maintain an ageing fleet if there are no reliability improvement requirements built into the life cycle support contracts of the aircraft. In the case of the new F/A-18 E/F model aircraft, the lack of accurate reliability data prior to fielding the aircraft lends itself for the manufacturer to become more involved with the supportability and maintainability of the aircraft during the initial years of fielding as well as throughout it's life cycle. The need for a subsequent maintenance support contract with Boeing (the prime contractor) has become essential in order to reduce life cycle costs.

F. SCOPE

The scope of the thesis focuses on the assessment of the new FIRST draft contract and its effectiveness on addressing the aircraft system and component reliability improvement issues. We will analyze management doctrine actions by the IPT in development of the FIRST and provide Contractor Logistics Support (CLS) background for assistance in understanding the concept of Government/Civilian Industry partnerships.

Due to the extensiveness of the FIRST program, our focus will not include issues relating to Fleet Support Timelines, or Information Systems Integration, both of which have terms and conditions addressed in the Award Fee Plan (AFP). [Ref. 2]

G. METHODOLOGY

An important part of this research effort is the literature review. As yet, there are no books of criticism available on the FIRST draft that may help in evaluating the program. Thus, in order to comprehend the FIRST in its entirety, the researchers considered the opinions of Government and Industry spokesmen as well as similar contracting strategies. The researchers will obtain copies of the existing FIRST draft being developed in conjunction by NAVICP Boeing, and NAVAIR.

This is accomplished through literature research including but not limited to, the following:

- Literature acquired through DoD representatives
- Professional journals and periodicals
- Research reports published by United States Military postgraduate schools
- United States DOD publications
- Government audit reports
- Interviews with industry spokesmen

H. ORGANIZATION

I. Introduction

- A. General
- B. Background
- C. Objectives
- D. Research Questions
- E. Discussion

- F. Scope
 - G. Methodology
 - H. Organization
- II. Background
 - A. Background
 - B. Contractor Logistics Support
 - C. Task Description Document
 - D. F/A-18E/F Integrated Readiness Support Teaming (FIRST) Program (draft)
 - E. Award Fee Plan
 - F. Summary
- III. Data
 - A. Supportability
 - B. Increased Reliability
 - C. Life Cycle Cost
 - D. Mean Time Between Failures
- IV. Analysis of Data
 - A. Parts Supportability Issues
 - B. Reliability and Maintainability Details
 - C. Life Cycle Cost
 - D. MTBF and Top Drivers
 - E. Summary
- V. Conclusions, and Recommendation
 - A. Conclusions

B. Recommendations

C. Suggested Further Studies

APPENDIX A. Task Description Document

APPENDIX B. FIRST contract (draft)

APPENDIX C. Award Fee Plan

APPENDIX D. F/A-18E/F Reliability and Maintainability Metrics 2001

REFERENCES

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II. BACKGROUND

The purpose of this chapter is to provide background information on the F/A-18 E/F aircraft and its maintenance support contract. This chapter will first discuss the background of the F/A-18E/F, second it will present an overview of Contractor Logistics Support (CLS) to give a better understanding of Government/Industry partnerships, third it will give details of the Task Description Document (TDD) [Ref. 3] developed prior to the FIRST, fourth it will provide a detailed description of the FIRST program (draft), and lastly it will give an explanation of the Award Fee Plan used in support of the contract.

A. BACKGROUND

The F/A-18 E/F is a multi-mission aircraft, a fighter and a bomber spanning the Navy's tactical mission spectrum from long range, sea-based dominance to "through the weather" deep strike interdiction. The Super Hornet will greatly exceed the capabilities of both the aircraft it is designed to replace as well as the aircraft it may meet on the battlefield.

The F/A-18 E/F Super Hornet is the newest version of the combat-proven F/A-18 Hornet. The aircraft is 25 percent larger than its predecessor but has 42 percent fewer parts. Both the single-seat E and two-seat F models offer increased range, greater endurance, more payload-carrying ability, more powerful engines, increased carrier bringback capability, enhanced survivability and a renewed potential for growth.

Seven production models landed at Naval Air Station Lemoore, Ca on Nov 17, 1999 assigned to VFA-122, a fleet readiness squadron. The Navy has ordered 62 Super

Hornets and plans to buy a minimum of 548 aircraft through 2010. The first class of new E/F pilots should graduate from VFA-122 in the early part of 2001. The first Super Hornet fleet deployment is scheduled for the spring of 2002.

Faced with declining resources, aging aircraft inventory, and rapidly escalating operating costs. For example, failure rates pertaining to the F/A-18 C/D models indicates a declining trend in Mean Flight Hour Between Operational Mission Failure (MFHBOMF) and Mean Flight Hour Between Failure (MFHBOF) rates. See Appendix D.

The Navy is examining every avenue to reduce costs while improving readiness and preserving high reliability. The Navy has become increasingly concerned with the decline in aviation readiness and the degree to which it had been unable to take necessary corrective actions. This FIRST is a method to attempt to maintain a high rate of readiness for the F/A-18 E/F.

B. CONTRACTOR LOGISTICS SUPPORT

There are numerous ways to obtain aircraft maintenance support from civilian contractors and Original Equipment Manufacturers (OEM). One overarching category is Contractor Logistics Support (CLS). [Ref. 4]

1. Background

Military aircraft have been classically supported with a three-level maintenance program that consists of organizational, intermediate, and depot maintenance tasks. Organizational level focuses on daily inspections, regular servicing and removing and replacing of components. Intermediate maintenance is the unit-level repair capability that includes off-equipment maintenance, such as in-shop component repair, and on-equipment scheduled inspection and repair of aircraft. Components and systems may be

repaired at the operating unit or a consolidated repair location or returned to a depot facility, depending on the specific discrepancy and the unit's repair capability. Depot maintenance is the most comprehensive repair, modification and overhaul capability for systems, equipment, and components, including rebuild, manufacture, or remanufacture of parts and components. In general, more extensive repairs are performed by depot maintenance activities, either on-site with field teams or at depot facilities. Maintenance depots are usually managed by separate logistics support commands.

The military services have sought economic benefits from the consolidation or streamlining of these classical levels, largely through the elimination of intermediate maintenance organizations when an item's reliability and spares level will allow the service to rely on premium transportation of parts between the operating unit and a repair depot or area repair center.

DoD develops its own maintenance programs for its aircraft weapon systems, largely in conjunction with the Original Equipment Manufacturer (OEM). Commercial aircraft in operation in DoD generally retain the commercial heritage of their maintenance programs, although there is significantly less emphasis on maintenance program adjustment and retention of airworthiness certification than in the commercial world.

2. Major Elements of System-Level Contracting

- *Depot maintenance* contracting is the largest type in terms of dollar value.
- *Interim contractor support (ICS)* is used for new systems to delay the acquisition of support equipment and technical data until the system configuration has matured. ICS generally replaces the intermediate and depot levels of maintenance for affected systems.
- *Contractor Logistics Support (CLS)* is principally applied to commercial off-the-shelf (COTS) and commercial derivative aircraft. The scope of

work can include all or portions of organizational, intermediate, and depot maintenance (as well as other logistics functions) for components and entire systems. CLS arrangements typically use a prime contractor with a network of subcontractors to accomplish heavy airframe tasks or specialized component and engine repairs.

- *Contractor Field Teams (CFTs)* are contract personnel utilized by base-level and depot-level requiring activities of all military services worldwide.

All of these contract types and groupings are capable of accomplishing any level of maintenance required to maintain the selected aircraft.

3. The Organizations

There are a variety of organizations that manage aircraft maintenance contracts in a segmented organizational structure. These organizations are geographically separated from one another rather than integrated, in marked contrast to the management practices in commercial airlines. These organizations are as follows:

- *Program Offices* manage the acquisition and lifetime support of major aircraft types.
- *Inventory Control Points (ICPs)* manage logistics support for in-service material, including acquisition of contract maintenance support. Depending on the particular service and organization, ICPs may be responsible for in-service items and systems; other ICPs may be responsible only for in-service items, with program offices in separate organizations responsible for managing in-service systems.
- *Unit-level contract management activities* contract for aviation maintenance performed at operating units. These organizations may be augmented with central offices at headquarters commands.
- *The Defense Contract Management Command (DCMC)* oversees system-level contracts at contractor facilities.

Military aircraft that were originally designed and produced as military equipment are generally unique to the military and have less potential to have their maintenance contracted to commercially oriented repair sources. Instead, the aircraft are typically contracted to defense oriented contractors that are specially equipped for the specialty workload.

Maintenance contracting has proven itself to be a safe and effective source of repair for DoD. While the military services use a wide variety of interconnected organizational segments to execute and manage aircraft maintenance contracts, they have been able to use the organizational network as a safety net to recover from management problems including maintenance personnel shortfalls, Depot realignment due to Base Realignment and Closure (BRAC) and OPTEMPO surge. When any one organizational segment has encountered difficulty, another segment has been able to help address the problem. Despite the increasing use of contracting to provide continuous mission support and the similarity of the management effort in each of the military services, there is little or no guidance at the OSD level specific to aircraft contract maintenance management,

4. Commercial Operations Within DoD

Approximately 8 percent of the DoD aircraft fleet (roughly 1,400 aircraft) is commercial or commercial derivative aircraft. COTS aircraft make up the largest subset with approximately 1,300 aircraft, and comprise the predominant fleets supported by CLS. Aircraft supported by CLS consume 25 percent of the flying hours of at least one military service. CLS is more like the type of contracting performed by commercial airlines, but is still distinctively military. Less than 300 aircraft are actually operated as commercially certified aircraft within DoD. There is a large population of other aircraft that had commercial counterparts, such as the P-3 and KC-135 but the commercial counterpart fleets are largely retired and the aircraft are no longer considered derivatives.

Outsourcing (changing from DoD in-house to contract support) requires careful transition planning to avoid workload and operational disruptions. This includes establishment of contract management organizations with adequate resources (including

training for the work force) for the new contract management task. DoD is refining its use of market research techniques to make better decisions for outsourcing.

CLS management activities have stable, long-range maintenance requirements that are predictable well in advance of the maintenance due date. Unfortunately, the Office of Management and Budget and DoD funding policies often limit the amount of available funding to quarterly or monthly funding allocations. Contracting activities spend an inordinate amount of their management attention structuring contracts to suit the funding allocations.

For many years the aviation community has been linked with outsourcing beginning shortly after World War II. DoD aviation outsources many maintenance activities, from depot level overhaul all the way down to the organizational level. The new FIRST contract with Boeing is yet another example among many of outsourcing logistics support.

5. DoD Support Contracting

Contracting within DoD for aircraft maintenance requires a blend of production and services contracting practices because aircraft maintenance encompasses both types of work requirements. For example, inspection and servicing are service functions, while repair, local manufacture, modification, and scheduling are production functions. Because of this, DoD requires more sophisticated contracting capabilities that are the specialty of system-level contracting organizations, but which may not exist in unit-level contracting activities. While most of the military services and the DLA have instituted training classes for various aspects of overall contract management, there is no joint

service training focused on maintenance, nor structured interaction to allow aircraft contract maintenance management activities to benefit from each other's experience.

DoD has a long-standing policy to adopt commercial products and practices, including the acquisition of commercial aircraft supported by contract maintenance. Issuance of the Federal Acquisition Streamlining Act of 1994 and the Federal Acquisition Reform Act of 1996 removed most major legislative impediments to the acquisition of commercial products. Passage of these laws has created a strong preference for the use of commercial supplies and services and the use of commercial practices where appropriate. The Federal Acquisition Regulations (FAR) and DoD's new 5000 series documents have been revised to incorporate the necessary changes in procurement policies, practices, and procedures to reduce impediments to the use of commercial items.

DoD deals with commercial sources to obtain contract support from the commercial marketplace for its fleets. Military contracting is in transition to more commercially oriented contracting as an increasing portion of military standards and practices are replaced with commercial counterparts.

6. Summary

Despite its challenges, the overall contract maintenance management process has worked effectively in DoD because the interlocking relationships between the operating commands, logistics commands and DCMC make it less likely that a management lapse in a single organization could jeopardize the entire structure.

C. TASK DESCRIPTION DOCUMENT FOR THE FIRST (DRAFT)

Under the F/A-18 E/F Integrated Readiness Support Teaming (FIRST) Program (draft), the government desires certain performance-based objectives related to the operational support of F/A-18 E/F aircraft. These performance objectives have been

jointly developed between the Government and Industry and are stated in the form of high-level end goals in the FIRST Contract presently in draft form.

The Task Description Document (TDD) defines at a more detailed level, how Boeing and its industry partners intend to accomplish the performance objectives stated in the FIRST Contract. The TDD describes the overall responsibilities of Boeing as the prime contractor under FIRST, which include Program/Business Management, In-Service Engineering (ISE), Supply Chain Management (SCM), Information Systems (IS) performance improvements and integration, Production and Field Support. Although the TDD represents a specific plan of how industry will provide operational support of E/F aircraft, the requirement of the FIRST Contract remains the performance objectives in the contract. It is therefore important to note that Boeing will have complete authority to deviate from the task described in the TDD and redirect resources in any way deemed appropriate in order to meet the performance objectives stated in the contract.

From the tasks described in the TDD, Boeing will develop estimates and establish a cost baseline for the FIRST Contract. These estimates will be reviewed with the government utilizing the Alpha contracting process. The goal is to establish a total cost baseline for Boeing and its partners to manage the FIRST Program.

1. Integrated Product Teams

From the beginning, the concept phase started with the idea of Integrated Product Teams (IPT). The strategy for this program has been jointly developed in a team environment, which includes all major stakeholders. The IPT concept is current, relevant, and pertinent to today's Naval acquisition environment. Our shrinking national defense budget and corresponding decrease in the availability of funds for research,

development, and procurement of new weapons systems have required the Navy Program Managers (PM) to find more efficient ways to meet their cost, schedule, and performance objectives. The IPT concept was implemented into the maintenance contract process to help the PM meet these goals.

D. F/A-18E/F INTEGRATED READINESS SUPPORT TEAMING (FIRST) PROGRAM (DRAFT)

1. Description of Program

The FIRST program is a sole-source procurement for total logistics support operating under a Government-Industry Partnership with Industry serving as the single focus for contractual accountability and management responsibility. The objective of the FIRST contract is to create a teaming arrangement between industry and the United States Government to improve parts availability and aircraft reliability for the F/A-18E/F Super Hornet with the overall goal of reducing Total Ownership Cost (TOC). The primary methods for accomplishing this will be continuous logistics processing with reliability and maintainability improvements. The Contractor will have management authority to meet system demand requirements, improve system/parts reliability and availability, and manage obsolescence.

2. Statement of Need

The current process of aircraft support is costly and unaffordable in today's funding environment. Dollars traditionally associated with support must be made available to address modernization efforts. The F/A-18 budget for logistics does not allow for execution to requirement at the current funding levels. This budget requirement was developed using the current organic process. This process affords relatively minor contractor participation and little Government-Industry teaming. This alternative support concept is required to streamline current processes and eliminate redundancies.

3. Description of Phases

Phase I of the FIRST program focuses on parts peculiar to the F/A-18 E/F, except for engines. Later phases of FIRST envision contractor support of all E/F parts, including those common to earlier F/A-18 models. The FIRST Program encompasses supply support, engineering and Integrated Logistics Support (ILS) services, publications, support equipment and training. Phase I of the FIRST Program will center on material management and reliability improvement. The FIRST program provides the capability for the contractor to manage responsibility for configuration control, obsolescence management and modernization through technology insertion and through analysis of parts usage, failure data and failure modes. FIRST draws upon efficiencies created by avoiding duplication of effort, integrating existing Government and industry capabilities and expertise, and adopting best business practices, while simultaneously addressing statutory CORE capabilities required by law (U. S. C. 2460, 2464 and 2469).

4. Life Cycle Cost

The FIRST concept draws largely upon the team's ability to reduce life-cycle costs (LCC) by approximately 13% over 30 years of the program. The total estimated program value over its 30 year life cycle is \$2.7 billion. This estimate is based on the cost of supporting the baseline process measured against estimated efficiency gains. The estimate accounts for all aspects of the FIRST program, including parts and labor. When the contractor formally proposes against the solicitation, a more definitive cost reduction estimate can be attained. Current cost estimates for the instant 5 year Phase I program are \$700 million.

5. Capability of Performance

In order to meet the desired objectives of FIRST and attain the estimated 13% LCC reduction, the Government-Industry team must be able to reduce repair cycle time of failed components and achieve a minimum 10% reliability improvement from the baseline estimates. The repair cycle reduction is designed to be facilitated by use of expedited transportation of material and guaranteed delivery of spare parts to support repair at the designated repair point. The minimum 10% reliability target is designed to be achieved by analysis of parts usage, failure data and failure modes. This analysis will enable engineering changes to be effected for unreliable components as well as items facing material obsolescence.

6. Depot Support

This effort will include F/A-18E/F supply support, engineering and Integrated Logistics Support (ILS) along with continuous product improvement and modernization. Boeing will subcontract with Navy Depot (NADEP) North Island, NADEP Cherry Point and NADEP Jacksonville as the major providers of depot maintenance support services. Supplemental services for depot repair will be provided by various Original Equipment Manufacturers (OEMs). Because Boeing is the airframe manufacturer and total systems integrator, they will be the lead, single point managers and be responsible for all Industry partners. The FIRST initiative will streamline and improve upon the traditional logistics process and provide significant savings to the Government.

7. Logistics Considerations

The basic tenets of FIRST allow the contractor to develop life cycle cost reductions through innovative support techniques, which include technology insertion and obsolescence management. The maintenance and support of squadron aircraft will

continue to remain with the U. S. Navy ("O" and "T" level functions). While the FIRST effort does not specifically identify and fund a warranty, Boeing will be responsible for total life cycle support. Reliability and maintainability will be designed into the process based on the proposed 10% reliability improvement target.

E. AWARD FEE PLAN

The purpose of this plan is to outline the overall strategy, define responsibilities, and establish the process required for the determination of Award Fee to be earned by the Contractor for performance of the FIRST contract.

This performance-based Award Fee Plan includes objective and subjective measures to assess the Contractor's performance under this contract. Metrics will be established and used to assess the Contractor's performance in the areas of cost control and technical performance relative to the requirements of the Performance Work Statement (PWS). The PWS contains the required services and levels of performance that will be evaluated in this award fee program.

F. SUMMARY

Since WWII DoD has partnered with the civilian sector in areas of logistics and maintenance. Despite this partnership, readiness rates have continued on a downward spiral due to funding, aging aircraft and reduction in personnel. This chapter delineates a new approach in partnering with a contractor to manage the logistics support for the F/A-18 E/F. In this chapter, we summarized the CLS techniques, the Task Description Document, (Appendix A) the FIRST contract (draft) (Appendix B) and finally the Award Fee Plan (Appendix C) as it pertains to the aircraft reliability and supportability issues.

III. DATA

This chapter provides data specified in the documents developed during the evolution of the FIRST contract that supports our research questions. It is divided up into four topics for discussion; Parts Supportability, Increased Reliability, Life Cycle Cost, and Mean Time Between Failure. Excerpts from the Task Description Document, the FIRST (draft), the Award Fee Plan, and data for the top drivers of reliability and MTBF's for the F/A-18E/F will be included following each discussion

A. SUPPORTABILITY

The goal of Naval aviation is to sustain aircraft throughout their life cycle with minimum cost and maximum readiness. One important issue relating to maintainability is parts support. "The FIRST Program provides for weapon system Supply Chain Management (SCM) responsibilities of selected F/A-18 E/F systems by the prime contractor with the goal of achieving improvements in logistics support and mission readiness while reducing O&S costs." (Appendix A)

Traditionally, the Naval Inventory Control Points and the Defense Logistics Agency provide parts support for naval aircraft. Although not all-inclusive, the number of parts covered under the FIRST contract is limited to those items listed in Appendix D of Reference 1. "The engines, tires, Forward Looking Infrared Radar, Combined Integrator Transmitter, Heads Up Display and APG73 are excluded from FIRST because they are bought in other procurement programs, or soon will be." [Ref 5] The Government's plan to contract for FIRST requires that many items formerly bought by NAVICP directly from individual OEMs under the Low Rate Initial Production (LRIP)

phase will now be purchased directly from Boeing as was done under the production contracts.

The following information is from the Task Description Document and lists those elements related to Parts Support.

Supply Chain Management (SCM)

SCM consists of administration, processing of customer requirements as well as acquisition of initial and replenishment spares and repair parts, management of repair services, providing asset management, and warehousing and distribution of material throughout the supply chain. The required outcome is lower inventory costs while providing repairable spares, field level repairables, and consumables required to support field maintenance and depot repair operations for select F/A-18 E/F weapon system components and E/F Peculiar Support Equipment (PSE).

Provide Forecasting Services

Boeing will utilize internal forecasting models to establish and maintain optimum wholesale inventory levels in support of the FIRST Program. This forecasting will be based on Government planning factors for aircraft distribution, projected flying hours, outfitting/allowance requirements, carrier deployment, contingency and war reserve planning, impact to related weapon system, and operational/training/test site utilization factors. Budget and investment constraints will also be identified.

Asset Management Data Repository

The SCM Team will maintain and update an asset management data repository making use of actual usage data and inventory visibility as well as Boeing demand and procurement information. The data will be filtered to ensure that only the most timely, accurate, and appropriate data is used in the forecasting and optimization models to establish and adjust wholesale inventory requirements. Historical demand data, planned reliability improvements, supplier, NAVICP, and NADEP input, along with program planning information will be collected and utilized to establish forecasted demands.

Managing Inventory

Having established optimum stocking levels and reorder points, as well as variance triggers for each part number at each location, Boeing will acquire initial inventories to meet established targets. Boeing will make extensive use of variance triggers established in GOLD to initiate analysis

that would result in stocking level or reorder point adjustments. Triggers will be established to monitor data coming into the system such as supplier lead-time, technical information and inventory availability for possible analysis. Triggers will also be established to monitor performance for changes in such areas as requisition fill rate, expected response times. Other triggers include, but not limited to:

- Depot or fleet maintenance planning data changes
- Trends in logistics cost drivers
- Obsolete part numbers or supplier problems
- Demand above or below anticipated value
- Design changes
- Unit cost changes
- Distribution, warehouse, and transportation network changes (Appendix A)

The following information is taken from Appendixes B and C, which includes data from both the FIRST contract, and the Award Fee Plan.

Contractor Responsibilities: The Contractor shall integrate a total support solution for the F/A-18E/F components defined in paragraphs 2.1 through 2.7. This includes meeting the demand requirements of the Operational sites, Intermediate sites and Depot sites, as well as repairing and/or replacing all parts covered by this contract including parts returned for repair that are determined to be beyond economical repair. The contractor will integrate all the support functions utilizing the following principles: 1) Supply Chain Management 2) Reliability Based Logistics/Trigger Based Asset Management 3) Government/Industry Teaming and 4) Integrated Information Systems. (Appendix B)

Specific Contractor Responsibilities stated in subparagraphs 2.4.1 and 2.5.5 from the Award Fee Plan are presented below.

2.4.1 The Contractor shall forecast, obtain, manage, transport, distribute, and warehouse wholesale material. The Contractor will be responsible for providing material support of all F/A-18E/F operations as defined in the F/A-18E/F planning documents listed below.

-Aircraft delivery schedule

-Projected Flying Hour Profile (F-18 E/F)

-Carrier deployment schedule (F-18 E/F)

-Site Activation Schedule

2.5.5 The Contractor shall provide the support required to maintain sufficient repairable assets to meet fleet availability requirements for all equipment as identified under paragraph 2.1 of this contract. (Appendix C)

The following two items as well as the data that follows were extracted from the Award Fee Plan to use as examples of items covered under the contract.

Award Fee Metric Details

- Supply Response Time (SRT) for Repairable and Consumable Stocked Item
- Repairable Items - Priority Designator Code 01-08 with a Required Delivery Date of 999, N, or E

Supply Response Time (SRT) for Repairable and Consumable Stocked Items.

Event categories are defined as follows:

Successfully Completed Award Fee Event: After receipt of a customer requisition, a stocked item is issued and received by the USN in 48 hours or less.

Unsuccessfully Completed Award Fee Event: After receipt of a customer requisition, a stocked item is issued and received by the USN in greater than 48 hours and less than or equal to 120 hours.

Unsatisfactory Award Fee Event: After receipt of a customer requisition, a stocked item is issued and received by the USN in more than 120 hours.

Non-Award Fee Event: The Performance Monitor may recommend to the ADO that an event beyond the control of the contractor be categorized, as a Non-Award Fee event. Upon ADO approval, the event will be removed from the performance calculation.

Uncompleted Award Fee Event: An event starting in the current Award Fee period but not ending prior to end of the current Award Fee period

General: This metric assesses the contractors' ability to fill Naval MILSTRIP requirements for stocked repairable and consumable parts whose source code is PA (Procured and stocked). Several response time categories exist under this metric as defined by Priority Designator and

Required Delivery Date combinations as shown in Table 1. Common metric performance covering each category, as well as individual SRT category performance details are defined and listed below.

Required Performance: Fill Naval requirements for stocked repairable and consumable material transmitted to the Contractor for several response time categories defined by Project Codes / Priority Designator and Required Delivery Date (RDD) combinations as listed in Table 1. Technical Performance Measures (TPM) applicable to all SRT categories is defined in Table 2. The corresponding percentage of TPM completion for each award fee period and fiscal year is listed in Table 3.

Define Measure: An award fee event is considered complete provided it is accomplished within the Award Fee Surveillance period as defined in the FIRST Award Fee plan. An award fee event that has not been completed during the current award fee period is considered incomplete and will be assessed in the Award Fee period in which it has been completed. A completed award fee event is further categorized as: a) successful, b) unsuccessful, and c) unsatisfactory.

A successfully completed award fee event is an event that meets or is less than the performance requirements listed in Table 1 SRT Response Matrix for each SRT category.

An unsuccessfully completed award fee event is an event that does not meet the expected performance requirements as listed in Table 1 and does not exceed the bound as defined in each SRT category description below.

An unsatisfactory completed award fee event is one that exceeds the performance requirement "Bound," as defined in each SRT category description below. Any unsatisfactory award fee events will decrement the total completed award fee events in the performance calculation for each SRT category.

Measure Start/End: The performance measurement for SRT starts at the Julian date of the requisition. The event ends upon confirmed receipt by the customer (CONUS) or confirmed receipt at the embarkation point (OCONUS and deployed units).

Performance Calculations: Performance calculations are shown for each repairable and consumable material requisition type, as listed in the Table of Contents. The performance calculation is defined as the percentage of successfully completed award fee events (minus any unsatisfactory award fee events) in relation to the total completed award fee events during the Award Fee period. Each repairable and consumable material requisition type is further defined herein and contains individual performance calculation examples. Requisitions issued prior to contract award will be

excluded from metric performance in award fee period one (1). (Appendix C)

B. INCREASED RELIABILITY

One of the factors contributing to aircraft readiness and ownership cost is the reduction of reliability rates as the systems age. Throughout the aircrafts' life cycle, elements such as environment, climate, shipboard operations, maintenance policy and operational tempo play a role in the deterioration of aircraft structures, systems, and components. These factors can affect the total ownership cost of weapon systems, resulting in significant funding shortfalls.

The Navy's goal in partnering with Boeing is to develop a maintenance support contract that will help alleviate the decrease in reliability rates of our naval aircraft over time. The contract represents an innovative method of incentivizing contractor performance improvements and inventory management practices for systems components and subcomponents throughout the system life cycle. "In order to meet the desired objectives of FIRST and attain the estimated 13% LCC reduction, the Government-Industry team must be able to reduce repair cycle time of failed components and achieve a minimum 10% reliability improvement from the baseline estimates." [Ref. 6]

Reliability mechanisms listed below will support the intent of the contractor of increase reliability rates during the aircrafts' the life cycle.

Provided below is information from the Task Description Document identifying specific data relating to reliability and maintainability.

Reliability Based Logistics/Trigger Based Asset Management (RBL/TBAM)

RBL focuses on reducing Operating and Support (O&S) cost by introducing more reliable designs, infusing new technology, and

developing more efficient support solutions. The objective of RBL/TBAM is to improve the aircraft availability and to enhance support systems, while reducing total life cycle cost (LCC). The cost of implementation (retrofit) is minimized and the LCC reduction is maximized by early introduction of these improvements. TBAM is a proactive approach to assessing trends in the performance of fielded systems and re-examining the support structure/plan when designated threshold triggers are exceeded. Triggers could include events such as hardware failure rates, diminishing sources of supply, repair cost, etc. System/component performance levels that are above or below the threshold triggers initiate an appropriate action.

To implement RBL/TBAM the FIRST contract specifies:

RBL/TBAM Triggers

Fielded components will be monitored regularly by the Supportability Assurance Readiness Program (SARP) Group to identify activated triggers. The integrity of the fielded data will be evaluated to affirm the validity of the data. Necessary improvements in data documentation will be communicated to the maintainers through the Hornet Support Center (HSC).

The FIRST In-Service Engineering (ISE) Team shall develop algorithms and threshold bounds required to identify when a component has activated a relevant trigger. Once a trigger has been activated, the component shall be entered into an RBL/TBAM system and assigned a tracking control number. The FIRST ISE Team shall maintain the RBL/TBAM triggers and update them as required, based upon a component's actual field performance and to reflect changes to improve reliability. Fleet Readiness data will be provided to Program Management to facilitate monthly assessment of FIRST performance metrics.

RBL Evaluation

Once validated, "triggered" components will be evaluated to assess opportunities for optimizing the support solution or improving poor performance through

- engineering change
- maintenance revision, e.g., changes to support equipment, repair procedures, etc.,
- technical manual clarifications
- sparing solution
- training solution

- Built-In-Test (BIT) update
- a combination of the above

Reliability Projections

Implement a system to project reliability impacts for design improvements, maintenance and training changes, and technical publication enhancements. These will be verified and updated with results of follow up evaluations.

Repair Database

An electronic repair database within the Help Request Document (HRD) system will be populated by Boeing and the NAVAIR Fleet Support Team (FST) to provide, document, track, and evaluate fleet repairs. This database will be managed and evaluated by Boeing to identify opportunities for support enhancements such as technical manual updates or maintenance revisions. This database will serve as a library of repairs for Boeing and NAVAIR FST engineers to employ in the development of subsequent field repairs and technical manual updates. (Appendix A)

The data contained here has been exported from the Award Fee Plan for use in describing the maintainability requirements for the Contractor (Boeing).

Repair of Repairables (ROR)

Any item failing to operate correctly shall be returned to the Contractor for repair or replacement, with no equitable adjustment to the contract. It shall be Boeing's decision whether to repair, overhaul and/or modify any item (to the extent that a modification is required, Boeing's authority under this contract is in accordance with the FIRST Class 1 Change Authority documented in Section 2.7). Items so repaired, replaced and/or modified are also subject to the provisions of this contract.

Systemic Improvements

The contractor is encouraged to make systemic improvements to increase operational effectiveness and efficiency so that technical performance, product quality, and schedule performance are improved and costs are reduced. (Appendix C)

The following information pertains to reliability evaluation criteria detailed in the Award Fee Plan illustrated in Table 1.

Required Performance: Monitor and analyze performance data of fielded components to assess performance or supportability trends. Identify opportunities for enhanced performance and/or supportability improvement. Develop and implement initiatives (e.g. engineering changes, maintenance concept changes, training changes, sparing changes, source of repair changes, etc.) to reduce the planned support cost of FIRST components.

Superior/Standard of Excellence:	The contractor's overall performance is superlative and few, if any, minor areas can be cited for improvement. Communications are completely open, timely, and effective. The contractor always identifies potential problems and proposed solutions in sufficient time to avoid negative impact to the program. Behavior is apparent that indicates creativity, ingenuity, initiative and/or excellent performance under adverse conditions in a cost-effective manner. The contractor's performance clearly exceeds contract requirements.
Very Good:	The contractor's overall performance is very effective. The contractor's performance is fully responsive to the contract requirements. Areas for improvement exist but have little identifiable negative impact on overall performance. Communications are generally open, timely, and effective. The contractor communicates with the Government in a manner timely enough to allow efficient turnaround of information and early identification of problems.
Good/Expected:	The contractor's overall performance is satisfactory and generally responsive to the contract requirements. Communication is good, but warrants improvement; few "surprises" have occurred. Areas for improvement exist which have identifiable, but not substantial, effects on overall performance. The contractor recognizes the need for improvement and is taking steps to improve.
Marginal/Threshold:	The contractor's overall performance meets or slightly exceeds minimum acceptable standards. Areas for improvement exist but few have adversely affected overall performance. Communications are not always open. The contractor sometimes identifies significant problems when it is too late to mitigate them efficiently. The contractor shows signs of recognizing the need for improvement, but has not taken steps to improve.
Unsatisfactory/Bound:	Performance at this level is indicative of serious mismanagement and requires immediate corrective action by the contractor. Significant deficiencies exist. Contractor's communications with the government are frequently inaccurate or misleading. The contractor is generally unsuccessful at anticipating and identifying problems before they occur. The contractor consistently demonstrates little effort to recognize or overcome shortfalls in performance.

Table 1. Technical Performance Measures.

	Government	Contractor
Performance Monitor	NAVAIR 3.0 F/A-18 Logistics	FIRST ISE Team
Data Collection Office	NAVAIR 3.0 F/A-18 Logistics	FIRST ISE Team

Table 2. Performance Monitors.

Database	1) FIRST ISE Reliability Based Logistics (RBL) Initiative Tracking database
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Table 3 Data Systems. "After Appendix C".

In order to determine the amount of the award fee the following explanations of measures is provided. They define subjective performance elements based upon the definitions in Table 1.

Define Measure: This metric measures the Contractor's effectiveness in evaluating, identifying, initiating and implementing improvements in reliability, maintainability or supportability. Award fee evaluation criteria for the contractor's performance are listed below.

Measure Start/End: This is a subjective performance element that will evaluate the contractor's performance related to improving reliability and maintainability. Ratings will be provided based upon the rating adjectives and definitions of Table 1.

Performance Calculations:

Criteria that will be considered when assessing Contractor performance include:

- Design change proposals for supportability improvement
- Built In Test (BIT) improvements identified for USN approval
- Life cycle cost analysis performed to validate initiative projected cost savings
- Reliability Based Logistics (RBL) analysis performed
- Verification of supportability improvements effectiveness
- IPT implementation of design solutions and potential support concepts
- Increases in Mean Flight Hours Between Demand (MFHBD) and/or Mean Time Between Demand (MTBD)
- Reductions in MRC deck driven maintenance requirements
- Technology insertion
- Reduction of component "Can not Duplicate" (A799) false removal rates
- Obsolescence Issues proactively identified and resolved (Appendix C)

The following information about life cycle cost has been obtained from the Acquisition Plan, and the Inspector Generals report on Aircraft Readiness.

C. LIFE CYCLE COST

Our airplane inventory is older now than at any other time in the history of Naval Aviation, yet through programmatic decisions and budget cuts, we have decimated the very engineering and logistics support efforts we now desperately need to sustain our aging aircraft into an increasing uncertain future. [Ref. 7]

The use of Boeing support for the new F/A-18 E/F is a way for the Navy to attempt to reduce life-cycle cost in the long run while increasing aircraft availability.

The FIRST concept draws upon the partnership of Boeing and the Navy to reduce life-cycle costs (LCC) by approximately 13% over 30 years of the program. The total estimated program value over its 30-year life cycle is \$2.7 billion. This contract allows Boeing to freely integrate best business practices and innovations in an attempt to decrease total ownership cost. "Due to reductions in funding for out-year support, the Government is willing to trade-off some level of control and infrastructure to the contractor in exchange for reduced life-cycle cost." [Ref. 6]

The following information was taken from the Task Description Document.

Reliability Based Logistics/Trigger Based Asset Management (RBL/TBAM)

The objective of RBL/TBAM is to improve the aircraft availability and to enhance support systems, while reducing total life cycle cost (LCC). The cost of implementation (retrofit) is minimized and the LCC reduction is maximized by early introduction of these improvements. (Appendix A)

This information was taken from the FIRST contract (draft).

Statement of Work

The Contractor shall independently manage a total logistics support program for the F/A-18E/F as identified in this contract. The Contractor will be provided financial incentives to be innovative and efficient and to reduce the Total Life Cycle cost of the F/A-18 E/F. This performance concept anticipates both logistics performance enhancements and cost of

ownership benefits from leveraging proven commercial support concepts.
(Appendix B)

D. MEAN TIME BETWEEN FAILURES

A major factor impacting readiness and total ownership cost is Mean Time Between Failure (MTBF). This indicator allows identification of the components and subcomponents that do not meet performance specification thresholds/objectives. Alternative measurements used for statistical analysis relating to maintenance failure parameters include but are not limited to; Mean Flight Hours Between Demand (MFHBD), Mean Flight Hours Between Failure (MFHBF), Mean Time Between Demand (MTBD), and Maintenance Man Hours Per Flight Hour (MMH/FH). By tracking the MTBFs of components we are able to pinpoint those items requiring improvements, modifications, or new technology innovations in order to ultimately increase the reliability of the aircraft.

Readiness degraders are items with the lowest reliability rates in a particular system. These items are the ones that would cause the readiness levels to be in the most jeopardy if failure occurs earlier than anticipated. Listed below are the top degraders for the F/A-18 E/F, as of March 16, 2001. [Ref. 8]

The graphs depicted in the third section below identify mission failure trends during the period from May 99 to Jun 00 for the F/A-18 E, followed by the F/A-18 F models. [Ref. 9]

1. Top Readiness Degraders

- DISPLAY UNIT, 01-455-1212
- HUD, 01-455-4501
- MPCD, 01-455-1412
- GCU, 01-455-3692

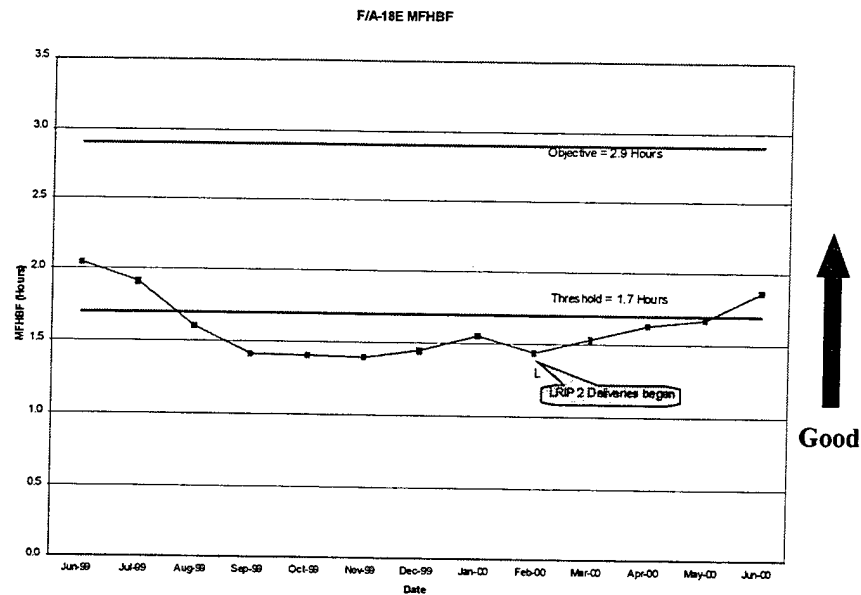
- PROCESSOR, SMP, 01-432-2474
- LAMP ASSEMBLY, 01-469-9550
- RESISTOR, THERMAL, 01-455-1428
- PIN, SAFETY
- COVER, AOA, 01-455-3715
- COVER, AOA, 01-461-7471
- LATCH, 01-478-0543
- LATCH, 01-465-6563
- FILTER ELEMENT, 01-463-6960
- CABLE ASSEMBLY, 01-454-5044
- FUEL SYSTEM VALVE, 01-469-3475
- TRANSDUCER, 01-455-1417

2. **MTBF Data Provided by NAVICP as of March 16, 2001**

		PREDICTED				
PART NUMBER	MRR1	MTBF	Failures	ACTUAL MTBF	NSN	Nomenclature
131000-49	1.4141	297.0087	9	1114.6014554501		Display Unit, Head-U
138200-9	0.0574	7317.0732	4	2507.9014551412		Control Interface
FH30001G2	0.3170	1324.9211	23	436.2014553692		Generator, Alternati
82370-01	0.0096	43750.0000	8	1254014322474		Processor, Signal
002009-1	0.0002	2100000.0000	2	5015.85014699550		Lamp Assembly
184AD	0.0681	6167.4009	4	2507.925014551428		Resistor, Thermal
SLZ7358	0.0004	1050000.0000	1	10031.7014553715		Cover, Electronic
74A328711-1001	0.0013	323076.9231	1	10031.7014617471		Cover, Access
TL12157-101	0.1356	3097.3451	0	No failures in 3M	014780543	Latch Assembly
TL12163-101	0.0578	7266.4360	0	No failures in 3M	014656563	Latch Assembly
5910775	0.5742	731.4525	0	No failures in 3M	014636960	Filter Element
74A926249-1001	0.0066	63636.3636	7	1433.1014545044		Cable Assembly
2930025-103	0.0094	44680.8511	1	10031.7014693475		Valve, Fuel System
210-B-42007	0.0216	19444.4444	0	No failures in 3M	014551417	Transducer, Pressure

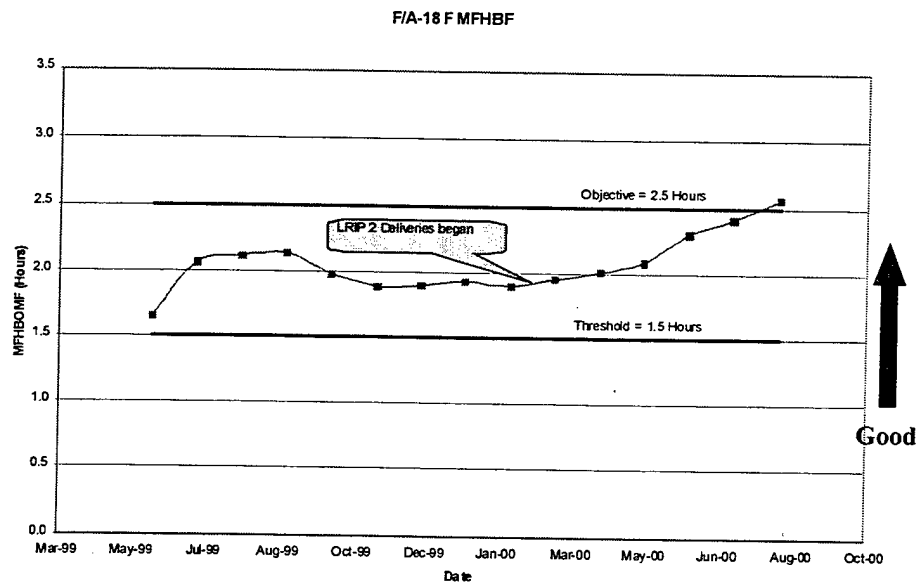
Figure 1. Top Degraders MTBF.

3. Mean Flight Hours Between Operation Mission Failure E and F models:



The objectives and thresholds are TEMP CTPs.

Figure 2. F/A-18 E MFHBF.



The objectives and thresholds are TEMP CTPs.

Figure 3. F/A-18 F MFHBF.

IV. ANALYSIS OF DATA

The purpose of this chapter is to analyze the information presented in the previous chapters in order to assess the quality and merit of the FIRST program. Our analysis is based on our own experiences as well as others who are involved in the logistics aspects of naval aviation.

A. PARTS SUPPORTABILITY ISSUES

When implemented, should the FIRST contract meet the expectations for parts supportability?

1. Supply Chain Management/Forecasting Services/Asset Management Data

The success or failure of the FIRST contract keys on the flexibility that Boeing will have in performing Supply Chain Management and forecasting services. Although dollar savings were not analyzed in this study, a Business Cost Analysis was performed in determining whether to outsource the logistics support for the F/A-18 E/F and it was determined that it was more cost effective to contract with Boeing for this support. [Ref. 10]

Contracting with Boeing appears to provide the Navy with additional flexibility that could not be possible with these services accomplished in-house. With the significant number of regulations and bureaucratic hurdles associated with government activity, this contract gives Boeing the opportunity to use more efficient industry practices to avoid government bureaucracy. Given that changes to the operational requirements of the Navy's aviation community are a certainty, contracting for logistics support appears to provide the Navy with the additional flexibility required to expand and

contract its logistics support effort to meet demand fluctuations inherent in an operational requirements curve.

Contracting for aviation logistics support also provides flexibility in the lead-time required for establishing the support of the F/A-18 E/F. Transferring the support from the Interim Logistics Support (the manufacturer of the system) usually takes two to three years. Not transitioning the logistics support from the Interim Support level eliminates this costly and time-consuming process, saving the Navy time, effort, and most importantly, dollars.

To ensure Boeing's success in Supply Chain Management, forecasting, and managing the Asset Management Data Repository, information will have to flow freely and easily between Boeing, NAVAIR, NAVICP, and the NADEPs. This information flow is vital for Boeing to accurately establish and maintain optimum wholesale inventory levels in support of the FIRST program. Projected flying hours, carrier deployment schedules, war reserve planning, historical demand data, and other operational and logistical information is vital to Boeing meeting these requirements.

The FIRST contract incentivizes Boeing to accurately collect and maintain the operational and logistical data and Boeing's profit motive serves the Navy's data collection needs.

2. Managing Inventory

The data Boeing will use in managing inventory is virtually the same data NAVICP would use. That data consists of items such as demand, supplier lead-time, technical information, inventory availability, and response times. Triggers in these areas will prompt Boeing to adjust inventory levels to meet these changes. The advantage

gained by Boeing managing these efforts instead of NAVICP is that Boeing has the technical expertise and the close relationship with its suppliers, whereas NAVICP would have to negotiate individual contracts with each supplier.

The contractor assumes the task of forecasting, obtaining, managing, transporting and storing wholesale material from NAVICP. The contractor is required to perform these tasks in the same manner as NAVICP however, the contractor has the incentive to do it cheaper, faster and better. The same free flow of information mentioned above is essential to Boeing effectively performing these tasks.

3. Supply Response Time

Boeing is required to meet the supply response times defined in the contract. These standards are virtually the same standards that NAVSUP Pub 485 specifies for the Navy Supply System. The response time requirements are based on Fleet Activity Designator (FAD), Project Code/Priority Designator and Required Delivery Date (RDD). The key difference is the incentives Boeing is being offered. If Boeing meets or surpasses the requirements the FIRST contract specifies, it will receive a cash award. This incentive is based on the successful rate of completed transactions over the total number of requisitions. This is a simple calculation to determine the success of Boeing's parts support capability.

One advantage to meeting this supply response time is the location of Boeing's warehouse. Whereas the various DLA distribution centers and NAVICP inventory holders are located throughout the United States, and the activity may get an item from any of these centers depending on item availability, Boeing has one main warehouse in Torrance, CA. The Navy is considering stationing its entire fleet of F/A-18 E/F models

in Lemoore, CA, a four-hour drive from Torrance. If the Navy decides not to station all of its E/F fleet in Lemoore, and decides to base them on both coasts, Boeing will have to decide whether or not to also have a warehouse on the east coast, or rely on the transportation system to expedite parts to the east coast.

4. Risks Associated With Parts Supportability

There are several risks inherent in a logistics contract. One of these is the possibility of a strike or other labor disruption against the contractor. Walkouts and slow-downs pose a very real threat to mission accomplishment. If the incident occurred during an emergency, the harm would far exceed financial considerations. An effective contingency plan would be invaluable should a strike occur.

Another risk is the possibility of marginal performance by the contractor. If Boeing fails to meet its contract obligations, no award fee is given. This will deincentivize their desire to exceed other aspects of contractual performance as no fee is awarded unless all contract provisions are satisfactorily performed. Going to the extreme, if the Government would deem it necessary to terminate the contract at the convenience of the Government or for default because of contractor's inability to perform, the Navy's support for the F/A-18 E/F would be jeopardized. With no logistics support of its own, the Navy would have to expeditiously devise contracts with suppliers, obtain inventory, gather data, obtain employment, and perform a myriad of other tasks to avoid losing combat readiness. This transition would be time consuming and very costly. The other option the Navy would have would be to obtain bids from a different contractor, but the core competency of Boeing's expertise would be lost.

A third risk or disadvantage is a loss of control. Contracting for logistics support services reduces the Commanding Officer and Supply Officer's direct control over the operation. The CO/Suppo does not have a direct line of authority to the contractor. Traditionally, the CO/Suppo could authorize support from NAVICP or DLA directly. This direct capability is limited because only the Administrative Contracting Officer (ACO) or Procurement Contracting Officer (PCO) has the authority to negotiate with the contractor. Currently, there is no plan to place a Contracting Officer Representative (COR) in Lemoore to negotiate aspects and oversee the performance of the FIRST Contract. The placement of a COR would greatly enhance the ability of the Navy to oversee this contract, and with the COR in close proximity, the CO/Suppo would gain some level of control. Aviation Support Department (ASD) Lemoore is not manned for oversight of this contract as it is performed by NAVICP in Philadelphia. [Ref. 10]

5. Parts Support Summary

The main components of the FIRST contract pertaining to parts supportability are very similar to the concepts and practices the Navy uses currently. Boeing will implement Supply Chain Management in managing its logistics support and retains the flexibility to implement industry practices in this process, whereas the Navy is inhibited by rules and regulations.

The requirements for meeting supply response times are virtually identical to the requirements the Navy imposes on itself. The key difference is that Boeing is contracted to do it, and has the incentive of cash awards if they meet or surpass this requirement.

There are always risks to contracting out logistics support. Although the risks may be low, they nevertheless must be weighed and evaluated. Although there are many

other smaller risks involved, three significant ones were described as being the most important and prospectively the most damaging.

B. RELIABILITY AND MAINTAINABILITY DETAILS

Should the FIRST contract meet the expectations for increased reliability and maintainability?

1. Reliability Based Logistics/Trigger Based Asset Management

RBL/TBAM is a fairly new concept in naval aviation logistics management. The introduction of more reliable designs, new technologies, and more efficient support provides an avenue for long-term cost savings. The F/A-18 E/F is the newest model aircraft in the Navy's inventory and is a good test-case platform to determine if these innovations will be successful.

The Trigger Based Asset Management system is a significant component of the continuous support program required to sustain up-to-the-minute maintenance data of failing aircraft systems and components. When the Navy's NALCOMIS and Boeing's GOLD systems are linked, they will both have instant access to reliability rates, which is crucial for future improvements and design decisions. The use of threshold bounds required to identify when a component shall be entered into the system will enable the contractor to save time and money otherwise used to obtain this information through conventional methods.

2. Long-Term Logistics Impact

Maintenance planning is a key element in the development of a good logistics plan. The long-term goals of a good logistics plan include but are not limited to:

- Maximize reliability
- Minimize maintenance factors
- Minimize cycle-time

These long-term objectives must be quantifiable, realistic, obtainable, challenging and congruent among the IPT members.

In any maintenance support contract under development, there are policies that set scope and terms of reference for actions. These policies include:

- Analyze and report threshold violations
- Review and report top 5 readiness degraders
- Review and report MTBF shortfalls
- Report inventory shortfalls

The FIRST contract has provisions to address all of the above policies except one; the review and report of MTBF shortfalls. The current contract (still under draft) uses alternative measurement guidelines identified in Chapter III.

There is no provision in the contract for the cost of those items that fall short of the MTBF expectations. The Navy normally pays for additional spares regardless of price, resulting in significant cost increases to the operation and maintenance of the aviation fleet. This issue has impacted the fleet resulting in drastic actions. For example, two F/A-18 wings were taken out of operational status for the period of one month at the end of FY 94, due to higher than expected engine failure rates.

3. Logistics Measures of Performance

As with most contracts, there are built in measures to evaluate performance of the contractor. Based on historical data, the typical evaluation methods include the following:

- Funding level adequacy
- Unfunded requirements
- Nature of process
- Value net performance

- Credibility
- Power focus (i.e., health of horizontal linkages)
- Key targets vs. measured performance (i.e., MTBF predicted vs. actual, cycle-time predicted vs. actual) [Ref. 11]

When referring to the FIRST contract, particularly the maintainability aspect, one only needs to focus on the last measure; predicted vs. actual performance levels. Although it is too soon to determine, it appears there is a viable means of identification for this measure. We cannot determine whether any components have been improved through the trigger based management system, as it has not been implemented.

4. Reliability and Maintainability Summary

The single most important long-term objective in the strategic plan is to maximize reliability up front and early. High reliability is fundamental to cost effective and efficient logistics, and contributes to readiness and combat power. High reliability results in less long-term support, inventory cost, personnel and training.

Subsequent reliability improvements are expensive and not always effective. For example, a 3 P-3 Orion aircraft study revealed that, starting with a reliability rate of 1.4 hours between mission failure, after 10 years of modifications and changes at a cost of over 500 million dollars (in today's real dollars), the reliability rate actually dropped to 0.7 hours between mission failures. [Ref. 11]

Total ownership cost of this system will greatly depend on how well Boeing can identify and improve reliability rates of the top drivers of system failures. Unlike the Navy and DoD supply systems, the FIRST contract provides incentive for component reliability improvement as Boeing's profitability rises when there are fewer failures. This incentive benefits the Navy in terms of readiness and reduced logistics cost.

C. LIFE CYCLE COST

Does the FIRST Contract have the Potential to Reduce the Aircrafts' Life Cycle Cost? Due to problems with aging aircraft, the use of best business practices with the F/A-18 E/F is an example of an attempt to reduce life cycle cost. Along with other innovations, Boeing should be able to decrease total ownership cost throughout the life of the aircraft. The freedom to innovate and enhance performance standards gives the industry market a distinct advantage over the old Military Specifications requirements. Boeing, as the prime contractor, is not encumbered by strict rules and regulations and can change the scope of methods used to reduce total ownership costs. DoD regulations have gravely restricted the ability to make changes in procurement and systems maintenance for naval aircraft, leading to excessive cost outlays over the life of systems.

A second key component of reducing life cycle cost is the use of financial incentives. This provides a means for government and industry to work together for the benefit of both to seek reductions in failure rates and increases in reliability and availability. Boeing is in the business to make a profit and these incentives provide profit opportunity while also benefiting the Navy.

D. MTBF AND TOP DRIVERS

What are the top reliability drivers relating to Mean Time Between Failures (MTBF)? And, should this new maintenance support contract improve the MTBF rates for existing F/A-18 E/F aircraft? The data presented indicates the top drivers of reliability based on high failure rate components identified in the supply system. This data is a snapshot of the high failure items currently under consideration for reliability improvement by both the fleet and the contractor. While the data are constantly changing, situation summaries are often developed for up-to-the-minute status of parts.

The items listed do not necessarily reflect the norms of traditional top drivers, which are those items that have the lowest MTBF (predicted) in the system. For example, one of the top drivers on the list is a Multi Purpose Color Display (MPCD). From a program standpoint, the top degrader is the MPCD due to the display obsolescence. This item is currently under modification testing for replacement. There is also a new technology being developed by the same manufacturer called a Digital Expanded Color Display (DECD), which, once incorporated into the aircraft, should save almost 50 percent of the present cost of this item, resulting from both price reductions and reliability improvements. [Ref. 12]

The list of top degraders is constantly changing while upgrades, modifications and improvements are being developed. The overall goal is for a system reliability improvement of 10 percent, while reducing total life cycle cost by 13 percent. While this might be difficult to keep track of, the program managers for the Navy and Boeing are working together to identify and improve those items that become the triggers of potential problems. For the first time, Boeing has been invited to the Navy's Aviation Consolidated Allowance List (AVCAL) symposium for the F/A-18.

We anticipate the top readiness degrader upgrades/improvements within the aircraft will be the most difficult to achieve. The invitation for Boeing to attend the symposium is an example of the increased visibility of such a joint venture between the Navy and Boeing.

NAVICP/DLA receive their funding from parts being sold. They have little or no incentive to reduce the number of parts "sold," thereby no incentive to reduce MTBFs.

Alternatively, FIRST has a built-in incentive for Boeing to reduce the number of parts "sold," thereby reducing MTBFs.

E. SUMMARY

Based on the analysis presented in this chapter, the FIRST contract addresses important key issues related to supportability, reliability and reductions in life cycle cost. Our analysis focused on how Boeing will support the F/A-18 E/F through Initial Operating Costs (IOC) and beyond.

The main components of the FIRST contract pertaining to parts supportability are very similar to the concepts and practices the Navy uses currently. The requirements for meeting these requirements are virtually identical to the requirements the Navy imposes on itself. The key difference is that Boeing is contracted to perform, and has the incentive of cash awards if they meet or surpass this requirement.

High reliability is fundamental to cost effective and efficient logistics, and contributes to readiness and combat power. High reliability results in less long-term support, inventory cost, personnel and training. Total ownership cost of this system will greatly depend on how well Boeing can identify and improve reliability rates of the top drivers of system failures.

The following chapter identifies our conclusions and recommendations based on our analysis. Each question will be presented in the order it was presented in Chapters I and IV.

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V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

1. **Parts Supportability - When Implemented, Should the FIRST Contract Meet the Expectations for Parts Supportability?**

- The utilization of the FIRST contract for the parts supportability of the F/A-18 E/F is a fundamentally sound concept. The beneficial impacts of the advantages of this contract far outweigh the consequences of the potential disadvantages. The flexibility and capability to implement Supply Chain Management should allow Boeing to effectively perform as the Inventory Control Point. Boeing is not subjected to government regulations, thereby having a greater latitude in improving areas of supportability by expanding and contracting its logistics support effort to meet demand fluctuations.
- The single, most important key to ensuring the adequate contractor support for parts is information flow. NAVICP, DLA, NAVAIR and Boeing must keep open lines of communication and information sharing to provide Boeing with the resources to sufficiently support this program.
- The main criteria being measured in Boeing's ability to provide adequate supportability is Supply Response Times. These response times identified in the First contract are identical to what is required in NAVSUP P-485. Providing all the F/A-18 E/Fs will be stationed in Lemoore, CA, the close proximity of Boeing's warehouse in Torrance, CA will assist in accomplishing the response times required.
- Another important factor in meeting the parts supportability requirements is the financial incentives Boeing can potentially receive if they meet or exceed the standards required by the FIRST contract. This is an ingredient that NAVICP and DLA have never had, thereby not having the financial incentive to perform.

2. **Reliability and Maintainability - Should the FIRST Contract Meet the Expectations for Increased Reliability and Maintainability?**

What are the top reliability drivers relating to Mean Time Between Failures (MTBF)? And, should this new maintenance support contract improve the MTBF rates for existing F/A-18 E/F aircraft?

- RBL/TBAM will give the contractor up to date information on failing or degrading parts in the system. As it stands now, NAVICP is doing the best they can to identify deficiencies in parts that cause reliability rates to be reduced through the use of the 3M system. With the future

interconnectivity of the NALCOMIS and GOLD systems, these system degraders will be significantly easier to identify and should provide more accurate and up to date data for future improvement analysis.

- The use of MTBF values is crucial for ease of degrader identification within the Trigger Based system. The current measurement guidelines identified in Chapter III, not using MTBF, falls short of the long-term objectives of quantifiable, realistic, and obtainable goals in terms of performance calculations.
 - The draft contract is too subjective in measuring contractor's effectiveness in evaluating, identifying, initiating and implementing improvements in reliability, maintainability or supportability. The predicted MTBF values are not the primary means of identification under the RBL/TBAM system. This leaves the performance calculation criteria (listed in the AFP) open for interpretation, resulting in subjectivity.
 - In terms of cost savings, there is no provision for extra allocation of funding to cover expenses of those items that exceed the required spare part allocation. This causes the Navy to spend significantly more money for spares. There is no contract contingency for funding spares that do not meet expectations and the contractor is de incentivized in that occurrence.
3. **Life Cycle Cost - Does the FIRST Contract have the Potential to Reduce the Aircrafts' Life Cycle Cost?**

Overall, if Boeing accomplishes the task of increasing readiness and maintaining parts supportability as stipulated by the FIRST contract, life cycle costs will decrease. The goal of reducing costs by 13 percent over 30 years is achievable. The freedom to innovate using technology and improved methods of supply chain management will greatly enhance the ability to reduce life cycle costs.

B. RECOMMENDATIONS

1. Parts Supportability

Based upon the research and analysis conducted, the following suggestions are made:

- Develop an effective contingency plan with the contractor in case of a strike or other labor disagreement.
- Provide NAS Lemoore with DCMA on-site support. This close support will greatly enhance the ability of the Navy to oversee this contract due to the close proximity. A COR placed at NAS Lemoore would be a valuable liaison between NAS Lemoore and Boeing, and additionally it would

assist in reducing the loss of control of the Commanding Officer and Supply Officer.

- Develop a contingency plan in case of default of the contract by Boeing or a decision to terminate by DoD. This contingency plan should also address the possibility that after the three successive one year options that Boeing or the Navy chooses not to continue the contract.
- ASD Lemoore currently manages Ready Maintenance Spares (RMS). These spares would be replenished in accordance with the FIRST contract by Boeing. Because of the technical experience of Boeing, they should manage these spares instead of NAS Lemoore.

2. Reliability and Maintainability

- Based on a model of System Life Cycle Cost, early decisions set the course for operations and support cost. Life Cycle Cost is considered effectively unchangeable shortly after Milestone II. Spending the money up front and early to obtain the best possible reliability rates is a factor that will save considerable funds in the long run. (Ref. 11)
- Techniques such as increasing redundancies within critical systems (using two of the same part) or creating systems with subsystems in series rather than parallel systems are effective ways to increase reliability and maintainability. Other means for increasing reliability include reducing variability within each system, like increasing the inherent strength of the part or decrease the nominal stress. High reliability is fundamental to cost effective and efficient logistics. Once the aircraft has been fielded, reliability improvements are expensive and not always effective. The contractor must be held accountable for failing to meet performance specifications.
- An example of non-traditional logistics measures of performance can include but are not limited to the following:
 - Funding requirements as a percentage of readiness levels
 - Replacement spares requirement based on MTBF performance specifications
 - Incentive fees as a percentage of readiness levels of performance
 - Different models of the same type aircraft should have different minimum readiness requirements placed on them due to system upgrades

3. Life Cycle Cost

As stated above the contractor must be held accountable for failing to meet performance specifications. These excess parts drive up costs that should be paid by the contractor. For future procurement, the Navy should verify system and subsystem parts

MTBF values during Operational Test and Evaluation. This will ensure parts meet predicted performance specifications and significantly reduce life cycle cost

C. SUGGESTED FURTHER STUDIES

This exploratory study has only begun to uncover the growing body of knowledge on the FIRST contract between the Navy and Boeing. Future studies could focus on the actual performance data, concentrating on Boeing's ability to provide sustained logistical support, including parts support, increased reliability and maintainability, and decreases in total ownership costs.

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APPENDIX A. DATA SPECIFIED IN THE TASK DESCRIPTION DOCUMENT (TDD)

This appendix is to provide data specified in the Task Description Document (TDD). The TDD lays the groundwork to what was intended to go in the FIRST contract. However, we will only list those items that are pertinent to the issues relating to aircraft supportability, reliability and life cycle costs. The following excerpts are taken directly from the TDD. [Ref. 3]

Reliability Based Logistics/Trigger Based Asset Management (RBL/TBAM)

RBL focuses on reducing Operating and Support (O&S) cost by introducing more reliable designs, infusing new technology, and developing more efficient support solutions. The objective of RBL/TBAM is to improve the aircraft availability and to enhance support systems, while reducing total life cycle cost (LCC). The cost of implementation (retrofit) is minimized and the LCC reduction is maximized by early introduction of these improvements. TBAM is a proactive approach to assessing trends in the performance of fielded systems and re-examining the support structure/plan when designated threshold triggers are exceeded. Triggers could include events such as hardware failure rates, diminishing sources of supply, repair cost, etc. System/component performance levels that are above or below the threshold triggers initiate an appropriate action.

RBL/TBAM Triggers

Fielded components, listed in Appendix X, will be monitored regularly by the Supportability Assurance Readiness Program (SARP) Group to identify activated

triggers. The integrity of the fielded data will be evaluated to affirm the validity of the data. Necessary improvements in data documentation will be communicated to the maintainers through the Hornet Support Center (HSC).

The FIRST In-Service Engineering (ISE) Team shall develop algorithms and threshold bounds required to identify when a component has activated a relevant trigger. Once a trigger has been activated, the component shall be entered into an RBL/TBAM system and assigned a tracking control number. The FIRST ISE Team shall maintain the RBL/TBAM triggers and update them as required, based upon a component's actual field performance and to reflect changes to improve reliability. Fleet Readiness data will be provided to Program Management to facilitate monthly assessment of FIRST performance metrics.

RBL Evaluation

Once validated, "triggered" components will be evaluated to assess opportunities for optimizing the support solution or improving poor performance through

- engineering change
- maintenance revision, e.g. changes to support equipment, repair procedures, etc.,
- technical manual clarifications
- sparing solution
- training solution
- Built-In-Test (BIT) update
- a combination of the above

Reliability Projections

The FIRST requires implementation of a system to project reliability impacts for design improvements, maintenance and training changes, and technical publication enhancements. These will be verified and updated with results of follow up evaluations.

Supply Chain Management (SCM)

The FIRST Program provides for weapon system Supply Chain Management (SCM) responsibilities of selected F/A-18 E/F systems by the prime contractor with the goal of achieving improvements in logistics support and mission readiness while reducing O&S costs. SCM consists of administration, processing of customer requirements as well as acquisition of initial and replenishment spares and repair parts, management of repair services, providing asset management, and warehousing and distribution of material throughout the supply chain. The required outcome is lower inventory costs while providing repairable spares, field level repairables, and consumables required to support field maintenance and depot repair operations for select F/A-18 E/F weapon system components and E/F Peculiar Support Equipment (PSE).

Reliability Improvements

Supplier Management & Procurement (SM&P) will coordinate reliability improvement suggestions between suppliers and NADEPs, production, FIRST ISE, and FIRST SCM asset managers. Reliability improvement suggestions will be processed in accordance with the procedures outlined in the RBL/TBAM process. SM&P will implement approved reliability improvements.

Manage Assets and Service Requirements

Boeing will use the Western Pacific Data System (WPDS) Government On-line Data (GOLD) system to manage the FIRST Program assets and requisitions.

System Interfaces

Boeing will establish interfaces with appropriate government systems and GOLD which will provide capabilities to ensure full-automated Military Standard Requisition and Issue Procedures (MILSTRIP)/Military Standard Transaction Reporting and Accounting Procedures (MILSTRAP) interface for management of the stock numbers.

Repair Database

An electronic repair database within the Help Request Document (HRD) system will be populated by Boeing and the NAVAIR Fleet Support Team (FST) to provide, document, track, and evaluate fleet repairs. This database will be managed and evaluated by Boeing to identify opportunities for support enhancements such as technical manual updates or maintenance revisions. This database will serve as a library of repairs for Boeing and NAVAIR FST engineers to employ in the development of subsequent field repairs and technical manual updates.

Provide Forecasting Services

Boeing will utilize internal forecasting models to establish and maintain optimum wholesale inventory levels in support of the FIRST Program. This forecasting will be based on Government planning factors for aircraft distribution, projected flying hours, outfitting/allowance requirements, carrier deployment, contingency and war reserve

planning, impact to related weapon system, and operational/training/test site utilization factors. Budget and investment constraints will also be identified.

Asset Management Data Repository

The SCM Team will maintain and update an asset management data repository accessing actual usage data and inventory visibility as well as Boeing demand and procurement information. The data will be filtered to ensure that only the most timely, accurate, and appropriate data is used in the forecasting and optimization models to establish and adjust wholesale inventory requirements. Historical demand data, planned reliability improvements, supplier, NAVICP, and NADEP input, along with program planning information will be collected and utilized to establish forecasted demands.

Strategic Plan

Boeing will develop a Strategic Plan that summarizes operational guidelines for the FIRST Asset Managers. The Strategic Plan will include all information used to establish stocking levels and reorder points for each operation site, USN repair facility, and distribution center. Also, the Strategic Plan will establish variance trigger parameters that, when exceeded, will be reviewed by the Asset Manager and forwarded, as warranted, to the FIRST ISE Team.

Tactical Plan

The Tactical Plan provides day-to-day operating objectives to the FIRST Asset Managers. The Tactical plan contains the optimum stocking levels and reorder points, as well as variance triggers for each part number at each location.

Managing Inventory

Having established optimum stocking levels and reorder points, as well as variance triggers for each part number at each location, Boeing will acquire initial inventories to meet established targets. Boeing will make extensive use of variance triggers established in GOLD to initiate analysis that would result in stocking level or reorder point adjustments. Triggers will be established to monitor data coming into the system such as supplier lead-time, technical information and inventory availability for possible analysis. Triggers will also be established to monitor performance for changes in such areas as requisition fill rate, expected response times. Other triggers include, but not limited to:

- Depot or fleet maintenance planning data changes
- Trends in logistics cost drivers
- Obsolete part numbers or supplier problems
- Demand above or below anticipated value
- Design changes
- Unit cost changes
- Distribution, warehouse, and transportation network changes

Sustaining Logistics

Boeing shall apply Systems Engineering principles and practices in the continuing development of support for the F/A-18 E/F weapon system. Boeing shall involve engineers in the systems engineering and LSA process to ensure that roadmap systems take full advantage of supportability enhancing features to eliminate, reduce, or simplify the requirement for the use of external SE. The goal is to minimize Turn Around Time

(TAT) for repair and operational performance verification of the weapon system or subsystem.

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APPENDIX B. EXCERPTS FROM THE FIRST CONTRACT (DRAFT) AND STATEMENT OF WORK

This appendix contains excerpts from the FIRST contract (draft), and the attached Statement of Work (SOW). Similar to Appendix A, only the material related to supportability, reliability and life cycle cost was extracted from the FIRST contract and related attachments. [Ref. 1]

F/A-18E/F INTEGRATED READINESS SUPPORT TEAMING (FIRST) CONTRACT (draft)

NOTES TO REVIEWERS

Boeing and Naval Inventory Control Point (NAVICP) contracts have mutually drafted the contract language contained herein. At the time of this report the contract was not in final form, therefore, the reviewers should understand that the content is subject to change. The following sections are taken directly from the FIRST (draft).

SECTION B - SUPPLIES/SERVICE/PERFORMANCE

For the base period of the contract, the contract type is a cost plus incentive fee (CPIF) contract with an award fee provision. Furthermore, the contract is a requirements type, performance-based logistics contract. The contract base period is from the date of contract award to 30 September 2002 and includes pre-contract effort...

In addition to the base period, the contract includes three successive one-year ceiling price options. The contract type for these options is fixed-price incentive-fee (FPIF) with an award fee provision.

This contract includes all provisions for the establishment and operation of a logistics support program for the F/A-18 E/F as described within the Statement of Work under Section C. The logistics support program implemented is performance based and gives the Contractor program management responsibility and authority to meet the program performance requirements defined herein.

SECTION C – DESCRIPTION/SPECIFICATION/WORK STATEMENT

1.0 GENERAL

The Contractor shall independently manage a total logistics support program for the F/A-18E/F as identified in this contract. The Contractor will be provided financial incentives to be innovative and efficient and to reduce the Total Life Cycle cost of the F/A-18 E/F. This performance concept anticipates both logistics performance enhancements and cost of ownership benefits from leveraging proven commercial support concepts.

2.0 CONTRACTOR RESPONSIBILITIES AND DIRECTION

The Contractor shall integrate a total support solution for the F/A-18E/F components defined in paragraphs 2.1 through 2.7. This includes meeting the demand requirements of the Operational sites, Intermediate sites and Depot sites, as well as, repairing and/or replacing all parts covered by this contract including parts returned for repair that are determined to be beyond economical repair. The contractor will integrate all the support functions utilizing the following principles: 1) Supply Chain Management 2) Reliability Based Logistics/Trigger Based Asset Management 3) Government/Industry Teaming and 4) Integrated Information Systems.

2.1 The contractor is responsible for providing the material in support of the air vehicle spare and repair demand, including initial outfitting, and peculiar support equipment (SE) end item repair and attrition. This material is further defined below:

2.1.1 Repairables: Support under this contract will be for the air vehicle F/A-18E/F unique WRAs, as defined by LCNs listed in Attachment (1); all SRAs that are components of the unique WRAs; and lower assemblies and piece parts that support these items....For common F-18 A-F SRAs, the contractor is responsible for filling all Navy F-18 A-F user requirements.

2.2 The Contractor is authorized to use Military Standard Requisition and Issues Procedures (MILSTRIP) to obtain material. Components ordered and/or obtained from the Federal Supply System are specifically not considered Government Furnished Material, but are considered Contractor Furnished Material. The Government makes no representations as to the availability of parts / material or other supplies in support of the effort described herein; nor shall the unavailability, late delivery, delivery of non-conforming supplies, higher costs of the Federal Supply System (FSS) (if any), or any other failure of the FSS to meet the expectations or requirements of the Contractor constitute excusable delay or grounds for equitable or any other adjustment of the contract or relief from the contractor performance requirements. The Contractor's requests through the FSS will either be filled, if stock is available, or canceled if a request cannot be filled. No requests will be backordered awaiting stock availability. If a request cannot

be filled and is canceled, the Contractor remains obligated to furnish the necessary parts/material required. The Contractor is required to pay for purchases from the FSS in accordance with then standard DLA or NAVICP practices.

2.4 Material Management

2.4.1 The Contractor shall forecast, obtain, manage, transport, distribute, and warehouse wholesale material. The Contractor will be responsible for providing material support of all F/A-18E/F operations as defined in the F/A-18E/F planning documents listed below.

- Aircraft delivery schedule
- Projected Flying Hour Profile (F-18 E/F)
- Carrier deployment schedule (F-18 E/F)
- Site Activation Schedule

2.5 Repair Of Repairables (ROR)

2.5.1 The Contractor shall manage all depot level repair and overhaul support for repairables, as defined in Section 2.1 of this contract.

2.5.2 The Contractor is authorized to enter a teaming arrangement with the NADEPs in accordance with Title 10 U.S.C. section 2553.

2.5.4 Any item failing to operate correctly shall be returned to the Contractor for repair or replacement, with no equitable adjustment to the contract. It shall be Boeing's decision whether to repair, overhaul and/or modify any item (to the extent that a modification is required, Boeing's authority under this contract is in accordance with the FIRST Class 1

Change Authority documented in Section 2.7). Items so repaired, replaced and/or modified are also subject to the provisions of this contract.

2.5.5 The Contractor shall provide the support required to maintain sufficient repairable assets to meet fleet availability requirements for all equipment as identified under paragraph 2.1 of this contract.

2.5.6 The Contractor shall provide all required repair parts to support repair program requirements in accordance with Section 2.1.

SECTION G – CONTRACT ADMINISTRATION DATA

G05 – SUBMISSION OF INVOICES

(h) The Government shall make fee payments to the contractor in the amount of .04 for every dollar of cost invoiced. Once 85% of the target fee has been paid , no further target fee will be paid until the contractor establishes a reserve of \$100,000. This reserve is meant to protect the Government's interest until completion of the CPIF CLINs. After the reserve has been established, the contractor will resume receipt of target fee.

SECTION H – SPECIAL CONTRACT REQUIREMENTS

H01 – OPTION TERMS (Applicable to CLIN's 0002AA, 0002AB, 0002AE and 0002AH)

(3) Option years will be added on the basis of the Contractor meeting the specified performance metrics, the Government's affirmative decision to proceed with the FIRST support concept, and the Contracting Officer affirmative determinations required by FAR Subpart 17.2. The incentive term may begin in year three (3), after

completion of years one (1) and two (2). The performance metric evaluation periods will follow the schedule outlined below. The contractor will have met the specified performance metrics for the period, if the award fee paid meets or exceeds the average of all "Threshold" levels.

Period	Performance	Ceiling Price Established	Proposal to Establish Follow-on FPI Firm Targets
Basic	Contract Award – 09/30/02	N/A	N/A
Opt. 1	10/01/02 through 09/30/03	096/30/01	03/31/02
Opt. 2	10/01/03 through 09/30/04	096/30/01	03/31/03
Opt. 3	10/01/04 through 09/30/05	096/30/01	03/31/04

Table (1). Option Pricing Due Dates

Period	Program Discontinuance Decision Date	Performance Metric Evaluation Period	PCO Option Year Notification of Intent
Opt. 1	06/01/02	10/01/00 – 03/31/02	07/01/02
Opt. 2	10/01/02	04/01/02 – 03/31/03	07/01/03
Opt. 3	10/01/03	04/01/03 – 03/31/04	07/01/04

Table (2). Pertinent Option Period Decision Dates

H02 – CONTRACT BASELINE

(1) Except in a sustained surge situation, as defined in Attachment (9), the parties will make an annual assessment to determine if an equitable adjustment is appropriate. This annual assessment will be based on changes and/or actuals to date and projections of the fleet performance remaining for the given fiscal year.....The estimated target cost, target fee, award fee and/or other non-monetary factors shall be adjusted for a given fiscal year only under the terms of this clause. Adjustment for sustained surge may occur as needed during the performance period of this contract.

H03 – SURGE CAPABILITY

The contractor shall maintain sufficient material stores, plant capacity and management oversight to accommodate unforeseen surges in actual flying hours. In the event of a short term or sustained surge situation, the surge plan in Attachment (9) outlines the roles and responsibilities of the parties.

H16 – AWARD FEE CLAUSE

2.0 RELATIVE WEIGHTS FOR AWARD FEE EVALUATION AND THE ALLOCATION OF AWARD FEE TO EACH EVALUATION PERIOD

2.1 The contractor shall be periodically evaluated by the Government across the entire performance period of this contract. The initial Award Fee evaluation periods and the respective initial performance elements and weightings for each evaluation period are identified in the Award Fee Plan attached to this contract.

2.2 The determination of the amount of Award Fee earned in each evaluation period, if any, shall be based on subjective and objective evaluations by the Government. These evaluations of the quality of the contractor's performance shall be judged in light of the criteria set forth in the Award Fee Plan. These criteria include the evaluation methods, performance elements, weightings and other Award Fee determining criteria. In no event can the combined weighted rating exceed 100% of the Award Fee available

for that evaluation period. Also, in no event can the combined weighted rating be less than 0% of the Award Fee available for that evaluation period.

3.0 AWARD FEE PERFORMANCE ELEMENTS FOR PERIODIC EVALUATIONS

The performance elements that will be evaluated are described in the Award Fee Plan. The performance elements and their relative importance may change from one evaluation period to the next. Specific definitions of the performance elements, rating methods and other rating criteria and methodologies are cited in the Award Fee Plan.

5.0 RESERVE AWARD FEE (AF) POOL

The Award Determining Official (ADO) may determine from time to time that unearned fee dollars be set aside in a separate reserve pool. The Government is under no obligation to make any of this reserve pool available to the contractor. If the ADO determines it to be in the Government's best interest and in support of the objectives of this contract, then he may make a part, or all, of these dollars available to recognize significant contractor accomplishments other than those covered in this clause or the Award Fee Plan. If the ADO determines all or part of this separate reserve pool should be made available, then the Government will notify the contractor in writing at least thirty (30) days prior to when the Government will begin its evaluation of contractor performance in the special area of emphasis. The written notification to the contractor will identify the available dollar amount, the areas of emphasis to which such Award Fee will be tied, and the milestones and/or periods during which the Award Fee may be

earned. The following table provides a reconciliation of the reserve award fee pool.

Description	AF Pool	AF Earned	Reserve AF Pool	Liquidated Reserve	CUM Reserve Pool
AF Period 1	\$3,620,032				
AF Period 2	\$3,620,032				
AF Period 3	\$5,662,615				
AF Period 4	\$5,662,615				
AF Period 5	\$381,445				
AF Period 6	\$381,445				
Total	\$19,328,184				

6.0 SYSTEMIC IMPROVEMENTS

The contractor is encouraged to make systemic improvements to increase operational effectiveness and efficiency so that technical performance, product quality, and schedule performance are improved and costs are reduced. To incentivize such improvements the contractor may request in writing to the Procuring Contracting Officer, via the Administrative Contracting Officer, that the contractor be given an opportunity to earn a portion of the Reserve Award Fee pool as described in paragraph 5.0 above. The request shall demonstrate the benefits to the Government of the suggested systemic improvements. Contractor requests submitted in accordance with this paragraph shall be limited to those systemic improvements that are in addition to any systemic improvements required to satisfy the requirements of this contract. The ADO shall determine whether any part of the reserve Award Fee pool may be used to emphasize any systemic improvements made by the contractor. If the Government decides to incentivize systemic improvements made by the contractor, then the extent to which the contractor will earn any such Award Fee shall be based on demonstrated performance improvements and/or reduced costs during at least one Award Fee evaluation period. The contractor's written request shall, as a minimum, include the following information:

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APPENDIX C. EXCERPTS FROM THE AWARD FEE PLAN

This appendix contains excerpts from the Award Fee Plan. Similar to Appendixes A and B, only the material related to supportability, reliability and life cycle cost was extracted from the Award Fee Plan. [Ref. 2]

AWARD FEE PLAN

1.0 – INTRODUCTION

The primary objectives of this Award Fee Plan are:

- To achieve maximum customer satisfaction.
- To pay fee only for performance meeting or exceeding the Government's minimum requirements.
- To motivate the Contractor to exceed the Government's minimum requirements.

2.0 – AWARD FEE INTEGRITY

Determination of Contractor performance and Award Fee eligibility will be based on a combination of both objective and subjective elements. This method of assessing performance will be limited to Contractor activities and functions in performance of this contract. The Contractor will not be held responsible for failure in achieving the performance measurements of the PWS for reasons directly attributable to the Government as determined by the ADO. The Contractor will have every opportunity to understand how the award amount is based on performance. Every effort will be made by the Government to assure fairness of evaluation as well as prompt and consistent feedback. Contractor performance, as assessed by the Government personnel involved in the program, will form the basis for Award Fee disbursements, with the final

determination made by the ADO.

3.5 – PERFORMANCE MONITORS

3.5.1 General

Government personnel will be identified as performance monitors to aid the AFB in making its recommendation for Award Fee. These monitors will submit written and/or oral reports, as required, on Contractor performance to the AFB for its consideration.

3.5.2 Instructions for Performance Monitors

Performance Monitors will maintain a continuous written record of the Contractor's performance. This shall include input from other Government personnel in the evaluation area(s) of responsibility. For subjective criteria, Performance Monitors will rate Contractor performance as superior, very good, good, marginal, or unsatisfactory using the definitions set forth in paragraph 7.1. Performance Monitors shall retain the informal records they used to prepare evaluation reports for six months after the completion of an evaluation period. These records will support any inquiries made by the ADO. Performance Monitors will conduct assessments in an open, objective, and cooperative spirit to ensure a fair and accurate evaluation. Performance Monitors will make every effort to be consistent from period to period in their approach to rating recommendations. Positive performance accomplishments should be emphasized just as readily as negative ones.

4.1 - AWARD FEE PERIODS

The Award Fee periods will be six (6) months in duration. The specific evaluation period dates are shown in Table 1.

PERIOD	START	MID-TERM	END DATE
1	Contract Award	01 Jan 01	31 Mar 01
2	01 Apr 01	01 Jul 01	30 Sep 01
3	01 Oct 01	01 Jan 02	31 Mar 02
4	01 Apr 02	01 Jul 02	30 Sep 02
5	01 Oct 02	01 Jan 03	31 Mar 03
6	01 Apr 03	01 Jul 03	30 Sep 03

Table 1. FIRST Award Fee Periods

4.3 - END OF PERIOD EVALUATIONS

The purpose of the final evaluation is to jointly assess the performance during the entire evaluation period, identify strengths and improvement items that occurred during the period, and recommend an Award Fee to be paid to the Contractor, if appropriate. The Award Fee evaluation will cover evaluation criteria that reflect the balanced approach desired in order to achieve the performance goals of the F/A-18E/F FIRST Program.

7.0 - AWARD FEE CALCULATION METHODOLOGY

Subjective and objective assessments will be used to assess the Contractor's overall performance and the corresponding amount of Award Fee to be earned during each Award Fee evaluation period. The criteria have been structured to achieve the performance based award fee objectives of the FIRST Program.

8.0 – PROCEDURES FOR USE OF RESERVE AWARD FEE

The Award Fee clause of the contract also permits the ADO to determine if a part or all of these dollars should be made available to recognize significant Contractor accomplishments other than those emphasized and addressed in the Award Fee criteria set forth in the Award Fee clause and this plan. The determination to place unearned fee dollars in a reserve pool and the determination to use reserve Award Fee dollars to recognize significant Contractor accomplishments other than those

addressed elsewhere in the Award Fee clause and this plan are at the sole discretion of the ADO.

AWARD FEE METRIC DETAILS

1. Supply Response Time (SRT) for Repairable and Consumable Stocked Items24
2. Repairable Items - Priority Designator Code 01-08 with a Required Delivery Date of 999, N, or E18
3. Supportability.....76

Supply Response Time (SRT) for Repairable and Consumable Stocked Items

General: This metric assesses the contractors' ability to fill Naval MILSTRIP requirements for stocked repairable and consumable parts whose source code is PA (Procured and stocked). Several response time categories exist under this metric as defined by Priority Designator and Required Delivery Date combinations as shown in Table 1. Common metric performance covering each category, as well as, individual SRT category performance details are defined and listed below.

Required Performance: Fill Naval requirements for stocked repairable and consumable material transmitted to the Contractor for several response time categories defined by Project Codes / Priority Designator and Required Delivery Date (RDD) combinations as listed in Table 1. Technical Performance Measures (TPM) applicable to all SRT categories are defined in Table 2. The corresponding percentage of TPM completion for each award fee period and fiscal year is listed in Table 3.

Define Measure: An award fee event is considered complete provided it is accomplished within the Award Fee Surveillance period as defined in the FIRST Award Fee plan. An award fee event that has not been completed during the current award fee period is considered incomplete and will be assessed in the Award Fee period in which it

period is considered incomplete and will be assessed in the Award Fee period in which it has been completed. A completed award fee event is further categorized as: a) successful, b) unsuccessful, and c) unsatisfactory.

- A successfully completed award fee event is an event that meets or is less than the performance requirements listed in Table 1 SRT Response Matrix for each SRT category.
- An unsuccessfully completed award fee event is an event that does not meet the expected performance requirements as listed in Table 1 and does not exceed the bound as defined in each SRT category description below.
- An unsatisfactory completed award fee event is one that exceeds the performance requirement "Bound," as defined in each SRT category description below. Any unsatisfactory award fee events will decrement the total completed award fee events in the performance calculation for each SRT category.

Measure Start/End: The performance measurement for SRT starts at the Julian date of the requisition. The event ends upon confirmed receipt by the customer (CONUS) or confirmed receipt at the embarkation point (OCONUS and deployed units).

Performance Calculations: Performance calculations are shown for each repairable and consumable material requisition type, as listed in the Table of Contents. The performance calculation is defined as the percentage of successfully completed award fee events (minus any unsatisfactory award fee events) in relation to the total completed award fee events during the Award Fee period. Each repairable and consumable material requisition type is further defined herein and contains individual performance calculation examples. Requisitions issued prior to contract award will be excluded from metric performance in award fee period one (1).

Repairable Items - Priority Designator Code 01-08 with a Required Delivery Date of 999, N, or E

Event categories are defined as follows:

- Successfully Completed Award Fee Event: After receipt of a customer requisition, a stocked item is issued and received by the USN in 48 hours or less.
- Unsuccessfully Completed Award Fee Event: After receipt of a customer requisition, a stocked item is issued and received by the USN in greater than 48 hours and less than or equal to 120 hours.
- Unsatisfactory Award Fee Event: After receipt of a customer requisition, a stocked item is issued and received by the USN in more than 120 hours.
- Non-Award Fee Event: The Performance Monitor may recommend to the ADO that an event beyond the control of the contractor be categorized, as a Non-Award Fee event. Upon ADO approval, the event will be removed from the performance calculation.
- Uncompleted Award Fee Event: An event starting in the current Award Fee period but not ending prior to end of the current Award Fee period

Performance is calculated in the following manner:

- The number of successfully completed award fee events less any unsatisfactory award fee events is divided by the number of completed award fee events for the evaluation period. Completed award fee events include all successfully completed, unsuccessfully completed, and unsatisfactory award fee events; less non-award fee events.
- To obtain a percentage value the calculated fractional value is multiplied by 100.

Example:

Number of successfully completed award fee events:	85
Less any unsatisfactory award fee events:	-5
Adjusted successfully completed award fee events:	80
Number of completed award fee events:	100
Performance calculation:	$80/100 = 80\%$

SUPPORTABILITY

Required Performance: Monitor and analyze performance data of fielded components to assess performance or supportability trends. Identify opportunities for enhanced performance and/or supportability improvement. Develop and implement initiatives (e.g. engineering changes, maintenance concept changes, training changes, sparing changes, source of repair changes, etc.) to reduce the planned support cost of FIRST components.

Superior/Standard of Excellence:	The contractor's overall performance is superlative and few, if any, minor areas can be cited for improvement. Communications are completely open, timely, and effective. The contractor always identifies potential problems and proposed solutions in sufficient time to avoid negative impact to the program. Behavior is apparent that indicates creativity, ingenuity, initiative and/or excellent performance under adverse conditions in a cost-effective manner. The contractor's performance clearly exceeds contract requirements.
Very Good:	The contractor's overall performance is very effective. The contractor's performance is fully responsive to the contract requirements. Areas for improvement exist but have little identifiable negative impact on overall performance. Communications are generally open, timely, and effective. The contractor communicates with the Government in a manner timely enough to allow efficient turnaround of information and early identification of problems.
Good/Expected:	The contractor's overall performance is satisfactory and generally responsive to the contract requirements. Communication is good, but warrants improvement; few "surprises" have occurred. Areas for improvement exist which have identifiable, but not substantial, effects on overall performance. The contractor recognizes the need for improvement and is taking steps to improve.
Marginal/Threshold:	The contractor's overall performance meets or slightly exceeds minimum acceptable standards. Areas for improvement exist but few have adversely affected overall performance. Communications are not always open. The contractor sometimes identifies significant problems when it is too late to mitigate them efficiently. The contractor shows signs of recognizing the need for improvement, but has not taken steps to improve.
Unsatisfactory/Bound:	Performance at this level is indicative of serious mismanagement and requires immediate corrective action by the contractor. Significant deficiencies exist. Contractor's communications with the government are frequently inaccurate or misleading. The contractor is generally unsuccessful at anticipating and identifying problems before they occur. The contractor consistently demonstrates little effort to recognize or overcome shortfalls in performance.

Table 2. Technical Performance Measures

	Government	Contractor
Performance Monitor	NAVAIR 3.0 F/A-18 Logistics	FIRST ISE Team
Data Collection Office	NAVAIR 3.0 F/A-18 Logistics	FIRST ISE Team

Table 3 - Performance Monitors

Database	1) FIRST ISE Reliability Based Logistics (RBL) Initiative Tracking database
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Table 4 - Data Systems

Explanation of Measure

Define Measure: This metric measures the Contractor's effectiveness in evaluating, identifying, initiating and implementing improvements in reliability, maintainability or supportability. Award fee evaluation criteria for the contractor's performance are listed below.

Measure Start/End: This is a subjective performance element that will evaluate the contractor's performance related to improving reliability and maintainability. Ratings will be provided based upon the rating adjectives and definitions of Table 1.

Performance Calculations:

Criteria that will be considered when assessing Contractor performance include:

- Design change proposals for supportability improvement
- Built In Test (BIT) improvements identified for USN approval
- Life cycle cost analysis performed to validate initiative projected cost savings
- Reliability Based Logistics (RBL) analysis performed
- Verification of supportability improvements effectiveness
- IPT implementation of design solutions and potential support concepts
- Increases in Mean Flight Hours Between Demand (MFHBD) and/or Mean Time Between Demand (MTBD)
- Reductions in MRC deck driven maintenance requirements
- Technology insertion

- Reduction of component "Can not Duplicate" (A799) false removal rates
- Obsolescence Issues proactively identified and resolved

Example:

- Contractor has identified 64 triggers thru continuous assessment of fleet maintenance data. Contractor has investigated 23 reliability/maintainability improvement opportunities, developed 13 RBL initiatives, approved 7 initiatives, implemented 4 initiatives and verified 2 initiatives.
- The 7 approved initiatives, based on the LCC analysis, netted a planned TOC reduction of \$1.2M. The FIRST program authorized \$0.65M funding for the initiatives.
- One initiative was verified to have increased the component MFHBD by 40%. The other reduced the MMH/FH on the system from 4 to 1.5 MMH/FH.
- Contractor's efforts have reduced false removals on 3 components; one by 5%, another by 25% and a third by 50% per flight hour.
- The contractor eliminated 20 man-hours worth of projected inspection requirements per 1,000 flight hours.
- Seven components were identified as obsolescent, i.e., they are or would no longer be procurable in the very near future. Five were resolved by procurement from an alternate source. One was resolved with a lifetime buy. Another is in the process of being evaluated for a redesign.

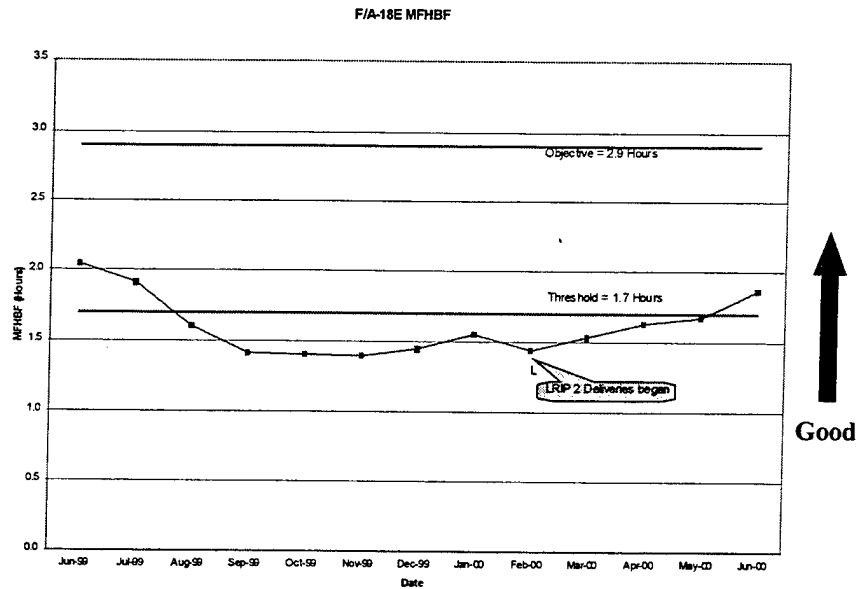
Assessment = Superior

The Performance Monitor will use the criteria above and other relevant information to determine the Contractor's earned Award Fee using Table 4. Using the example performance calculations, the contractor earned 100% of the Award Fee for this metric. If no Award Fee events occur, the Performance Monitor will report no performance.

Supportability	
Contractor Performance	Award Fee Amount
Superior/SOE	100%
Very Good	90%
Good/Expected	80%
Marginal/Threshold	70%

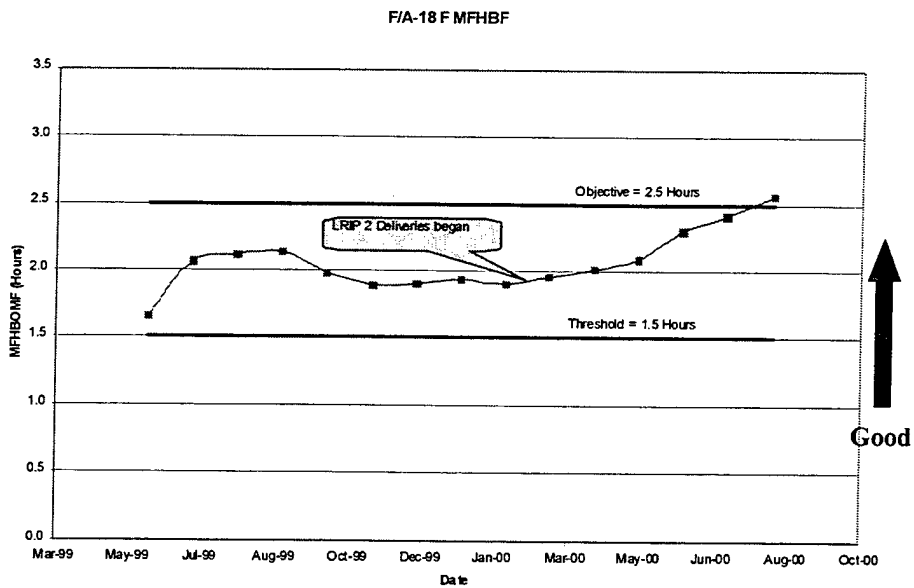
Table 4. Award Fee Conversion Chart

APPENDIX D. F/A-18 E/F RELIABILITY AND MAINTENANCE METRICS 2001 [REF. 9]



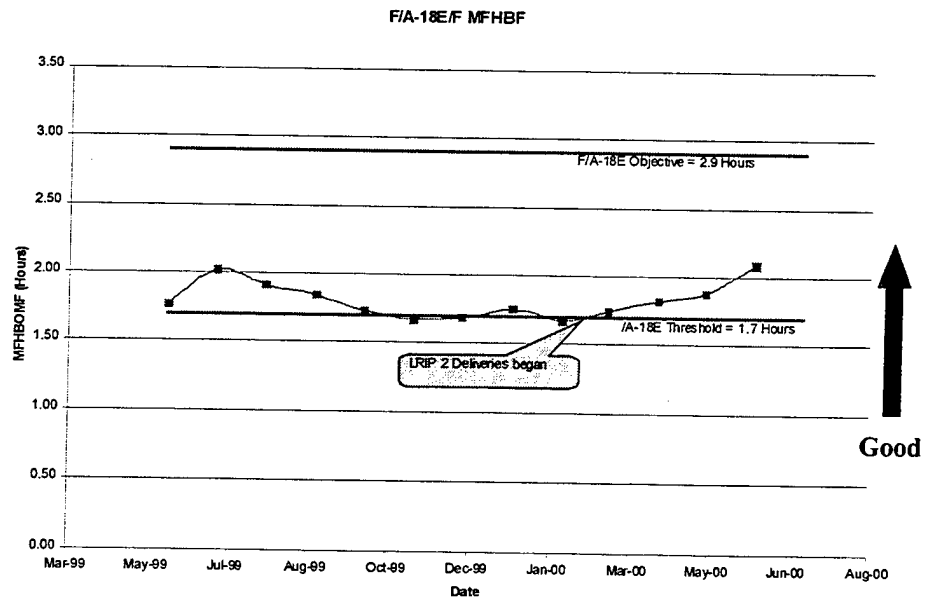
The objectives and thresholds are TEMP CTPs.

Figure 1



The objectives and thresholds are TEMP CTPs.

Figure 2



The objectives and thresholds are TEMP CTPs.

Figure 3

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